ARMY ORDNANCE

VOL. XXXI, No. 157 JULY-AUGUST, 1946

ORDNANCE SGT. B. F. CHEYDLEUR
Predicted atomic bomb damage

A REVIEW OF INDUSTRIAL PREPAREDNESS FOR NATIONAL DEFENSE
PUBLISHED BY THE ARMY ORDNANCE ASSOCIATION, WASHINGTON, D. C.

"Wherever highly stressed, heavy-duty parts are called for, we specify...

NICKEL ALLOY STEELS"

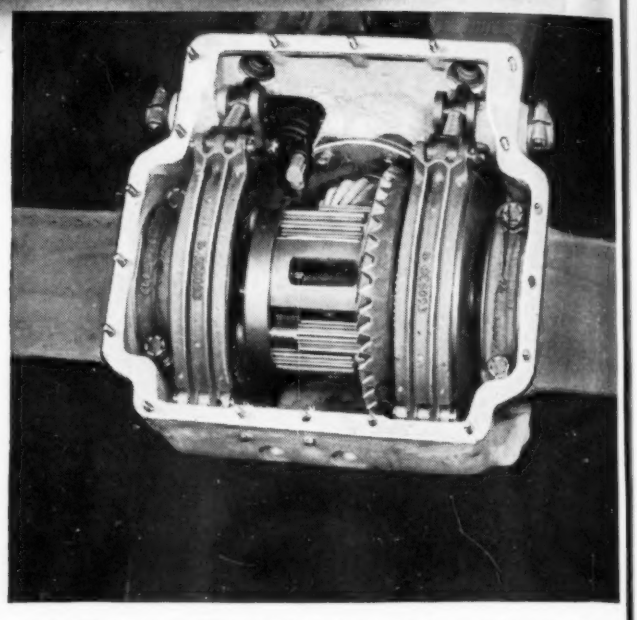
Spicer Manufacturing Corporation

TOLEDO, OHIO

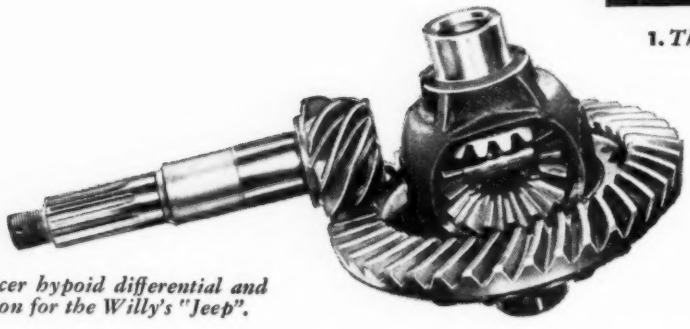
Like most progressive transmission builders, Spicer engineers know that since the earliest days of motor transport, Nickel alloy steel gear units have been noted for reliability and performance.

In case and core they're extra strong and tough... because the use of the right Nickel alloy steel imparts greater strength and promotes depth hardening without loss of toughness, or danger of embrittlement.

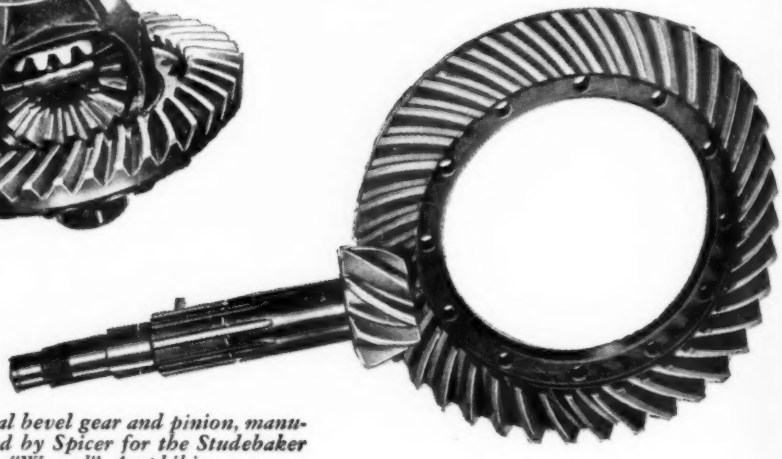
We offer counsel and data on the selection, treatment, fabrication and use of Nickel alloys.



1. *The famous Water Buffalo transmission with cover off. Manufactured by Spicer.*



2. *Spicer hypoid differential and pinion for the Willy's "Jeep".*



3. *Spiral bevel gear and pinion, manufactured by Spicer for the Studebaker "Weasel" Amphibian.*

THE INTERNATIONAL NICKEL COMPANY, INC.

67 WALL STREET
NEW YORK 5, N.Y.

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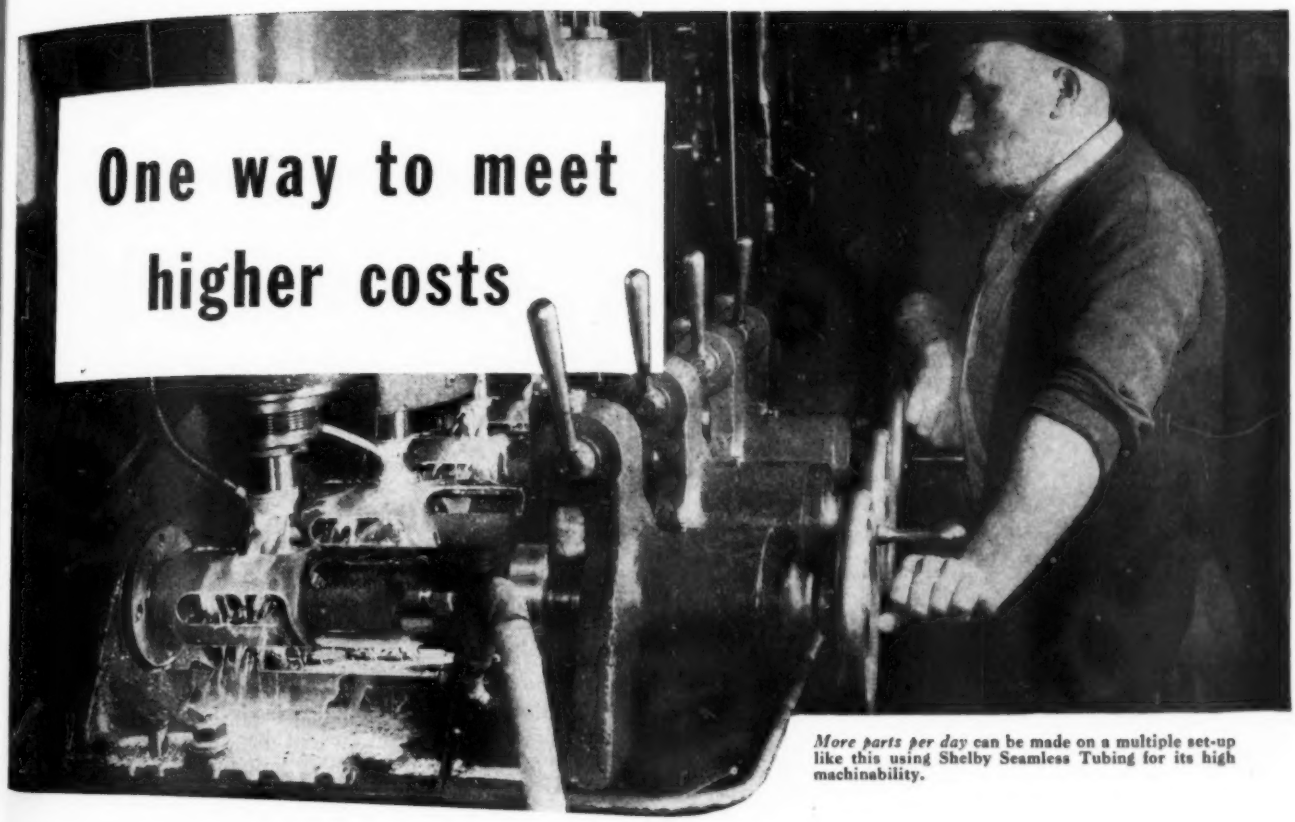


More parts per day can be made on a multiple set-up like this using Shelby Seamless Tubing for its high machinability.

Use Seamless Tubing and get more production per man-hour

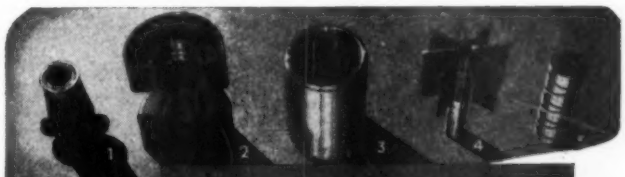
It takes ingenuity to figure out ways to combat rising costs, but you can profit from the experience of others.

During the war, manufacturers learned that seamless steel tubing had advantages over solid forgings on scores of jobs. Production was increased many times by set-ups such as the one illustrated above.

With Shelby Seamless Tubing you start out with the basic shape already made. This eliminates at least a forging and certain machining operations. The better machinability of Shelby Tubing and its uniform high quality permit fast production. Parts can be turned out at considerably less cost than those made by slower methods.

You can obtain Shelby Seamless Tubing processed to suit your particular requirements. Our service engineers work with you and with our own metallurgical department to develop the material most suitable for your machining operations.

Sizes of Shelby Seamless Tubing range from ⅜ inch to 10½ O.D. inches and in wall thickness from .035 inches to 1.500 inches cold drawn. Write for complete details and analyses available.



1. Connector for truck and trailer. 2. Roller for tractor. 3. Bearing shell. 4. Pump impeller. 5. Winder for textile machine.

SHELBY SEAMLESS *Steel Tubing*

WALLS WITHOUT WELDS

NATIONAL TUBE COMPANY
PITTSBURGH, PA.
Tubing Specialties Division
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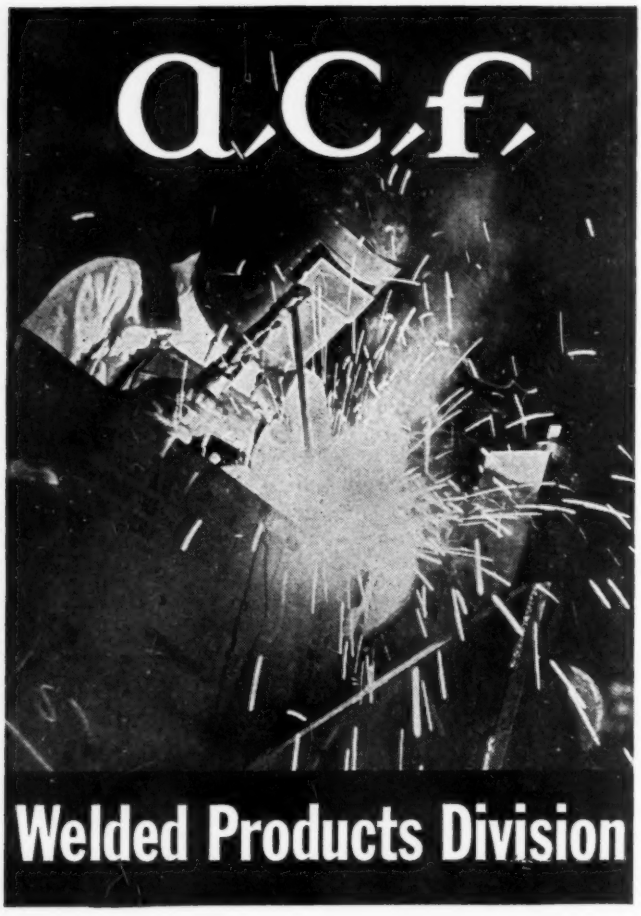
UNITED STATES STEEL



During recent years great progress has been made by A.C.F. in welding techniques and methods. The full potentiality of welding is now being realized in manufacturing methods—resulting in the establishment of THE WELDED PRODUCTS DIVISION of the American Car and Foundry Company.

This Division is developing weldments for all lines of products. Through weldments and welding procedures great savings are realized.

This means better products at a lower cost—Whatever A.C.F. Builds It Is Known To Build Well!

AMERICAN CAR AND FOUNDRY COMPANY

New York · Chicago · St. Louis · Cleveland · Washington
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New Developments

A NEW BETATRON FOR ORDNANCE

A 20,000,000-volt betatron unit, or X-ray machine, for the examination of artillery shells and bombs has been installed at Picatinny Arsenal in a building especially constructed for it. The betatron will "look" through twelve inches of steel, revealing cavitation in shells or bombs and any imperfections in the steel casings.

The unit was originated by the University of Illinois and was manufactured by the Allis-Chalmers Manufacturing Company. There is another such gigantic X-ray at Rock Island Arsenal, and a smaller unit is slated for Aberdeen Proving Ground, but this is the first time that a building has been designed and erected around the machine.

NAVY ROCKET WEAPONS

Two new rocket engines, with thrust greater than that of the German V-2 bomb, and other modern rocket weapons that are the most powerful in the world were revealed recently at the Naval Air Test Center, Patuxent River, Md.

"Tiny Tim," the most powerful air-borne rocket known today, was demonstrated as were other high-velocity rockets, including the 5-inch Navy aircraft rocket.

In addition, a new rocket motor called "Moby Dick" which is expected to be converted to increase the speed of aërial rockets such as "Tiny Tim," was shown for the first time. This engine, with a thrust of thirty tons, was developed for the Bureau of Ordnance by the Bureau of Aëronautics, which anticipates further development that would open fields of distances and speeds heretofore untouched.

Also revealed for the first time was the liquid-propellant rocket engine developed by the Bureau of Aëronautics for its high-speed Gorgon pilotless aircraft. Known as the CML-2N, the compact engine delivers a thrust of 350 pounds for a period of over 2 minutes.

MINIATURE "ATOMIC" BOMB TESTS

Miniature "atomic" bomb tests are being conducted at the Navy's model basin, Carderock, Md., in conjunction with the "Crossroads" experiment. Scale-size models of Victory ships, approximately two feet in length, are used in the miniature tests to obtain advance data on the effect of the bomb blast on the actual ships to be subjected to the experiment at Bikini. The models are built on a scale of 1 to 220 and are bombed while floating in an improvised pond representing Bikini Atoll.

A model "atomic" bomb containing a charge scaled down from 20,000 tons of TNT, is used for the tests. It is fired underwater and in the air over the pond. Data obtained from the effect of the model bomb on the scaled-down ships will be compared with scientific information gathered from the Bikini experiments. The comparison will provide a check on the accuracy of methods employed at the model basin, which normally subjects ship models to accurate scientific tests to obtain specific knowledge of a vessel's performance before its construction.

ROCKET LANDING DEVICE

Rocket devices invented by the late Prof. Robert H. Goddard, famous rocket expert, are beginning to be made public through the issuance of U. S. patents.

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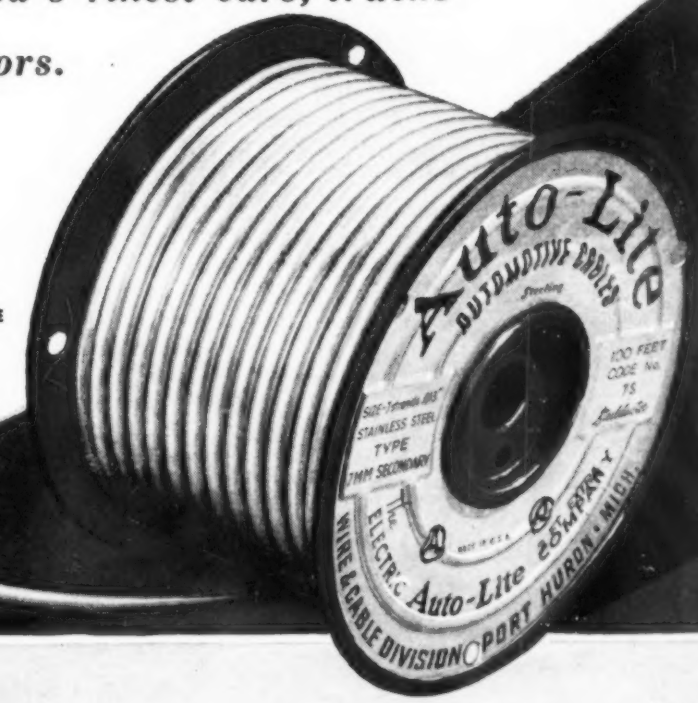

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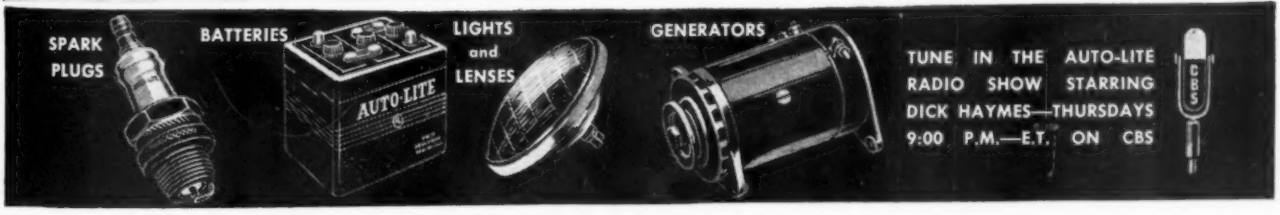

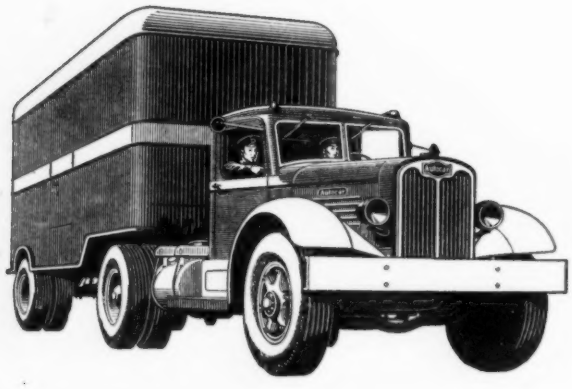

SUPERBLY ENGINEERED

What *you* put into Autocar Trucks is important. What Autocar's master engineers put into Autocar trucks is vital. It's the superb engineering that enables you to say, "The Autocar will arrive at 0600." It's the stamina that gives you less trouble, mile after mile, and year after year. . . . Autocars cost more *because they're worth more.*

AUTOCAR TRUCKS

Engineered for HEAVY DUTY

MANUFACTURED IN ARDMORE, PA.
FACTORY BRANCHES AND DISTRIBUTORS
IN PRINCIPAL CITIES

New Developments

One of them is a design for a rocket-landing device to receive the high-speed stratosphere craft which rocket propulsion may make possible. This device is a big tube closed at one end with a trumpetlike flare at its open end. The rocket craft is expected to enter this while wheels at various points on its circumference help to guide it smoothly.

As the rocket ship passes into the narrower part of the tube it will practically fill it and thus act as the piston in a huge pneumatic shock absorber. As its nose reaches the closed end it will contact a final checking device built on the principle of an artillery recoil cylinder.

GLASS-LINED CLOTHING

The Navy has developed glass fiber-lined clothing for greater protection against cold and wet weather. The glass-insulated clothing, which consists of a helmet, suit, mittens, and boots, was designed primarily for the protection of submarine and open-boat crews assigned to the bridge.

The clothing is lined with quilted, spun-glass batting made from thousands of glass fibers, each with a diameter of about four microns, or a fraction of a human hair. The fineness of the fibers increases dead air space for greater insulation and gives the material the pliability and feeling of cotton.

Laboratory and field tests reveal that the glass fiber lining combined with rubber-coated nylon retains more body heat, yet is twenty-five per cent lighter than the present regular issue gear.

AN 8-BLADED AIRCRAFT PROPELLER

An 8-bladed counterrotating propeller unit for high-speed airplanes has recently been developed. The unit consists of two 4-bladed propellers in tandem. The changing of propeller angles is accomplished by natural physical forces instead of the conventional electric or hydraulic "gear shifting."

RUSTPROOF POCKETKNIFE

A new pocketknife that defies rust and corrosion has been developed by the Army Quartermaster Corps. It comprises a large spear-pattern cutting blade, a leather punch, a can opener, and a combination cap-lifter and screwdriver with a stud. The new knife's four blades are made of a recently developed high-carbon cutlery steel. The knife is 3¾ inches long when closed, has stainless-steel springs and handles, brass bolsters, and nickel-silver rivets and clevis. The new steel is tough, free-grinding, and capable of maintaining a cutting edge slightly better than straight carbon cutlery steel.

NEWEST DIVE-TORPEDO BOMBER

The Navy's newest dive-torpedo bomber, the mighty Martin Mauler, was designed for operation off the new large aircraft carriers of the MIDWAY class. A heavy, long-range multipurpose plane, it is at present the Navy's most powerful single-seater dive bomber torpedo craft.

The Mauler, designated the BTM by the Navy, was designed and built by the Glenn L. Martin Company, Baltimore, Md. It is powered by a Pratt & Whitney Wasp Major engine with a military rating of 3,000-horsepower, the world's largest aircraft engine. Its large 4-bladed Curtiss electric propeller measures fourteen feet, eight inches, in diameter.

The Mauler, as a dive bomber, can carry 4,000 pounds of bombs or rockets. In an alternate capacity as a torpedo bomber, it carries one torpedo with additional rockets or bombs. It mounts four 20-mm. cannon.

IMMERSION SUITS

Because a man can live only a few minutes in Arctic waters without protection, the Air Transport Command is securing

Recognized dean of axle engineering is Colonel Herbert W. Alden: Engineer Consultant to Chief of Ordnance; winner of Frank Scott medal for "service to national defense"; twice-president of S.A.E.; Chairman of S.A.E. Advisory Committee. He has been Director of Engineering for The Timken-Detroit Axle Company since 1909. Colonel Alden has supervised the development of most of the axle engineering improvements of the past 38 years.

An apple from the teacher

A LONG-TIME friend and teacher to young men in motor transport is Colonel Herbert W. Alden.

Here's what he has to say about young engineers coming up in motor transport today:

"Motor transport has produced many outstanding engineering achievements in the past—and many up-and-coming young men have had their share in them.

"But it is only the beginning. I am certain that the best things have not yet been done—spectacular developments are ahead! Young engineers with the proper training and knowledge can make them come true.

"At Timken Axle, we are planning scores of new developments and projects that only highly skilled engineers can do. Here, new advancements will be made by applying the superior weight of combined engineering knowledge against any given problem."

Timken's executive engineering staff is backed by a group of young engineers with an aggregate of more than 600 years of experience in the design and development of axles and brakes! No other organization can duplicate this specialized knowledge of load-carrying, load-moving, and load-stopping problems.

The research and technical resources of Timken Axle are, as always, available to the Army to help make motor transport *stronger,* our national security *greater.*

The Accepted TIMKEN AXLES Standard

TIMKEN AXLES

THE TIMKEN-DETROIT AXLE COMPANY, DETROIT 32, MICH.
WISCONSIN AXLE DIVISION • OSHKOSH, WISCONSIN
TIMKEN AXLE BRAKE DIVISION • DETROIT 32, MICH.

Cut your own Trees and Firewood with

SALLY SAW

the one-man portable motor-driven power saw

A revolutionary new idea in a power-driven portable one-man saw that will fell or cut up hard or soft wood. Sally Saw weighs less than 69 lbs., and can be easily carried and operated by any woodsman. Simplified design and use of lightweight materials help to make the Sally Saw the most up-to-the-minute saw on the market.

Whether you are a large operator in pulpwood cutting or an individual with a wood lot for firewood cutting, the Sally Saw will be found to be economical in the first cost and low in operating cost. Sally Saw will save time and money for all wood cutters.

Because of the radically new design of the Sally Saw's 16-inch diameter cutting member, the standard model will cut through an 11-inch diameter tree or log with one pass in quick time.

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CUMMINGS MACHINE WORKS
BOSTON U.S.A.

New Developments

10,000 synthetic, plastic-coated, high-strength cotton-material immersion suits. The suits are entirely watertight and go on over all other outer clothing, including the Mae West life preserver. It can be put on by a novice within thirty seconds and by an expert within ten seconds. Originally designed for Arctic conditions only, it will be useful in all climates where continuous water immersions are probable.

NEW PLASTIC PROTECTS FROM SUN

A special ultraviolet-absorbing type of Lucite acrylic resin that will give protection from sunburn to fliers and persons riding in vehicles equipped with transparent plastic tops has been developed by Du Pont. The new material is being manufactured in clear and green transparent sheets, the latter offering antiglare properties in addition to filtering out the harmful portion of ultraviolet.

JEEP-MOUNTED MINE DETECTOR

A jeep-mounted mine-detector set, capable of searching a path six feet wide along a road at a speed of three to five miles an hour, was perfected during the closing months of the war. This detector, designated as the AN/VRS-1B by the Army Signal Corps which directed its development and production, is mounted on two wheel-supported brackets extending five feet ahead of the jeep. When the detector passes over a spot where a mine has been buried it actuates an electrically controlled mechanism that stops the jeep within one or two feet.

GAS TURBINES FOR THE NAVY

For the past five years the Navy has been in the midst of a development program which will ultimately provide a new source of ship propulsion power. Since 1941 the Navy has been developing the gas turbine in coöperation with many commercial firms. An experimental model has been under test for the past two years. This previously secret gas-turbine unit has been operating at 1,350 degrees Fahrenheit, the highest temperature yet sustained for long periods of time.

The gas turbine, which operates much the same as a steam turbine except that it uses hot air instead of steam to spin the turbine blades, has many advantages over the steam turbine. It does away with the necessity of installing boilers, condensers, and complicated steam lines in ships, and the gas-turbine cycle can be operated at much higher temperatures than the practical limitation of 850 degrees Fahrenheit now present in steam-turbine construction for shipboard use.

This means that gas turbines can be designed to weigh less, occupy less space, or maintain higher thermal efficiency than the steam turbine—thus greatly increasing the cruising range of Navy ships.

HELIUM IN PEACE

The world of science is seeking new uses for helium gas whose wartime production of 370 million cubic feet from 1941 through 1945 by the United States Bureau of Mines was twice man's output in all history to the end of 1940.

Among its newest applications, helium saves as much as the weight of an average person when used in place of air in big airplane tires. Many new uses for the gas, which always has been and still is a United States monopoly, are being sought.

Construction of four new extraction plants in Texas, Kansas, and New Mexico during the war changed helium from a laboratory curiosity costing $2,000 a cubic foot to a plentiful commodity costing about one cent a cubic foot.

CHEMICAL PROPELLANT FOR V-1 BOMB

Development of liquid chemical propellants that give pilotless bombs a speed of 250 miles an hour by the time they leave a launching ramp only 160 feet long can now be revealed as

HIGH STRENGTH

N-A-X HIGH-TENSILE STEEL HAS ALL SIX—KEEPS ALL SIX

- HIGH STRENGTH
- EASY FORMABILITY
- EXCELLENT WELDABILITY
- HIGH FATIGUE-RESISTANCE
- GREAT IMPACT TOUGHNESS
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GREAT STEEL FROM GREAT LAKES

FOR LIGHTER WEIGHT . . . LONGER LIFE IN TRANSPORTATION EQUIPMENT

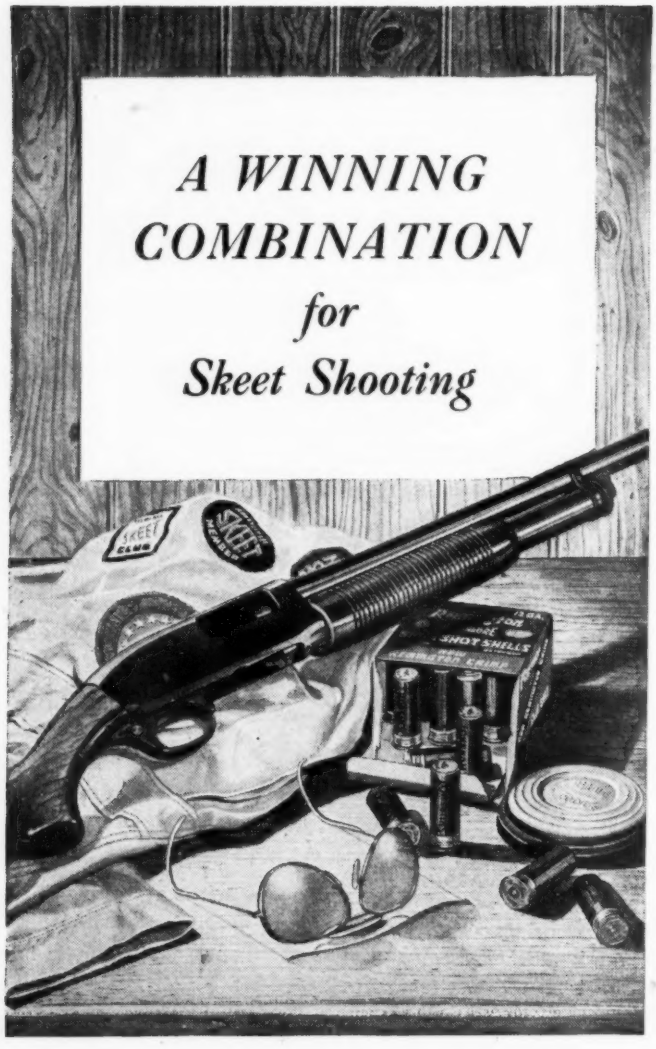
Combining great inherent strength with exceptional formability, N-A-X HIGH-TENSILE steel has wide application in the design of improved transportation equipment. Where reduced weight means increased efficiency, its high physical properties may be utilized to permit thinner sections; if greater durability is the important consideration, identical sections can be made stronger and tougher with N-A-X HIGH-TENSILE steel.

Consistent with the trend toward lighter, more efficient designs, N-A-X HIGH-TENSILE benefits the field of transportation by eliminating deadweight in favor of greater payloads.

GREAT LAKES STEEL CORPORATION

N-A-X ALLOY DIVISION • DETROIT 18, MICHIGAN

UNIT OF NATIONAL STEEL CORPORATION



Skeet is a great sport—one you can enjoy for years to come. However, your fullest appreciation comes as your skill increases. And that's when you find that the *right* gun and the *right* ammunition count most.

Champion skeet shooters have found a *winning* combination in the Remington Model 31 shotgun and Remington Shur Shot shells with the New Remington Crimp. The Model 31 is a pump action repeating shotgun which, during the war, aerial gunnery students nicknamed "the gun with the 'ball-bearing' action" because of its velvety-smooth operation. And Shur Shot shells with the New Remington Crimp eliminate "blown patterns" which cause those unexplainable misses. There is no top wad to obstruct the shot charge. Thus, you get even distribution of shot pellets with no holes or openings for targets to pass through unbroken.

For free literature on this popular combination, write Remington Arms Company, Inc., Bridgeport 2, Conn.

Remington

DUPONT

"If It's Remington—It's Right"

Shur Shot is a trade mark of Remington Arms Company, Inc.

New Developments

one of chemical warfare's secret projects of World War II. Known as the "Fred" project, the research work occupied a staff of thirty chemists and engineers who worked for eight months to develop an allied V-1 bomb.

AN "INDESTRUCTIBLE" PLASTIC

A new industrial plastic that withstands acids which dissolve gold and platinum and retains its strength and form at higher temperatures than any known organic material has recently been disclosed. It is already contributing importantly to modern engineering developments such as the jet engine, in which it is the only plastic that will stand up under the high temperatures to which it is subjected. Radar and television are among other fields in which it is solving serious problems.

The plastic material, tetrafluoroethylene resin—to be known by the trade-mark "Teflon"—was developed in Du Pont research laboratories. It is claimed that no substance has been found which will dissolve or even swell the polymer, including such potent reagents as aqua regia, chlorosulfonic acid, acetyl chloride, boron trifluoride, hot sulfuric acid, hot nitric acid, and boiling solutions of sodium hydroxide.

Subjected to a temperature of 572 degrees Fahrenheit continuously for three months in a recent test, it showed virtually no degradation and retained all its useful properties at that elevated temperature. Conversely, it is not adversely affected by temperatures as low as 75 degrees below zero Fahrenheit.

NEW NAVY SUPERCHARGER

The first "2-stage" turbosupercharger in the world has been developed for use in Corsair airplanes, making possible efficient operation at altitudes above 40,000 feet—10,000 feet higher than the normal service ceiling for this standard Navy fighter. It is being installed in one complete squadron of Corsairs which will go through experimentation and tactical evaluation at very high altitudes.

DISTILLATION BY COMPRESSION

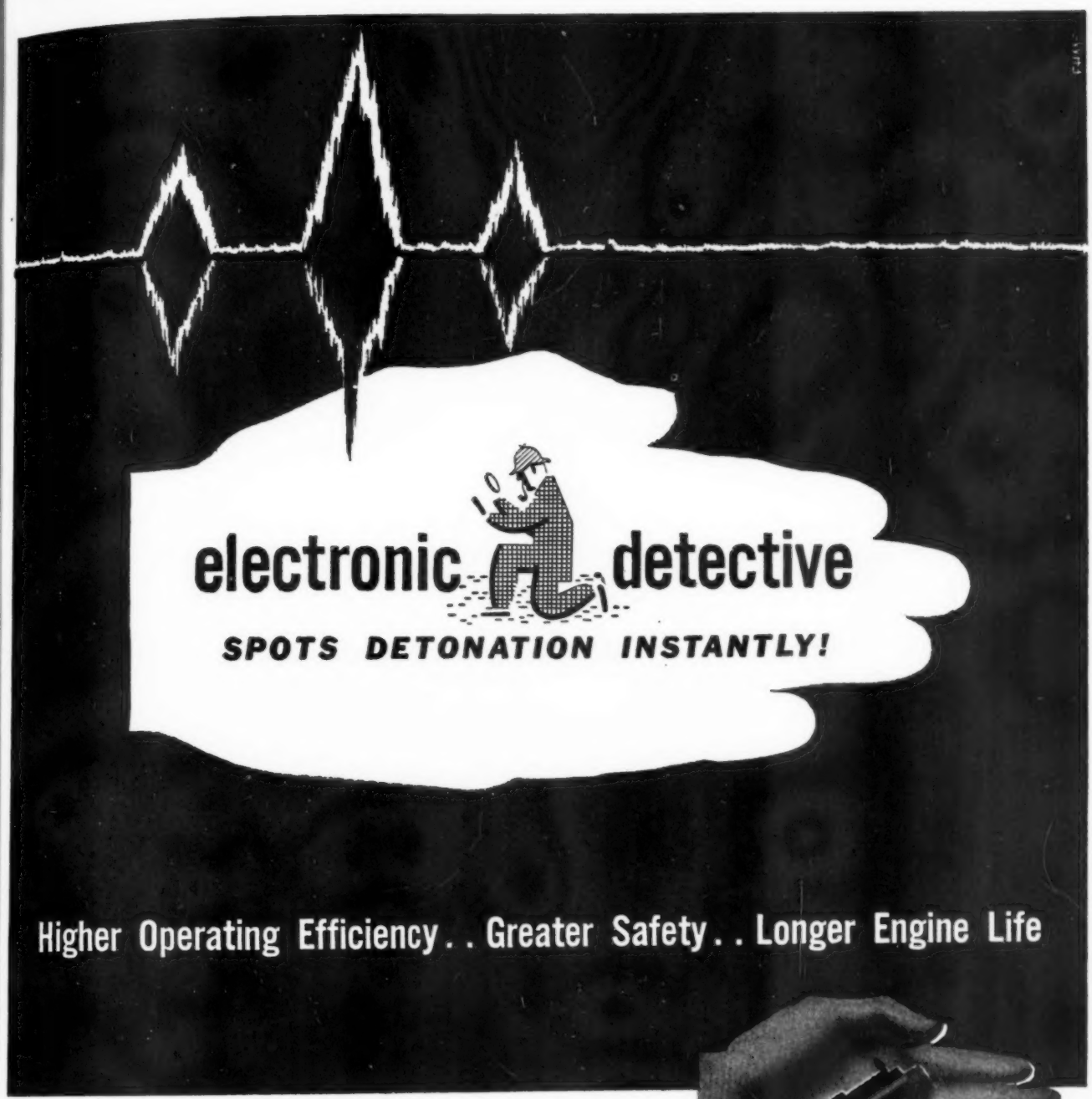
A new method of distilling fresh water from sea water was devised during the war by Commodore R. V. Kleinschmidt, U.S.N.R., the Navy recently revealed. It involves distillation by means of mechanical energy instead of externally applied heat, which is used in all other types of distillation and evaporation. "Compression distillation," as the new method is called, gives a yield of about 175 pounds of water for each pound of fuel used.

Compression distillation depends upon mechanically compressing the steam or other vapor leaving the evaporation compartment of the still. Such compression raises the temperature of the steam a few degrees. At the higher pressure the steam condenses at a temperature somewhat higher than the boiling point of evaporating raw water so that heat can flow from the condensing steam to the raw water and boil it. Efficient provision for reducing heat loss to the atmosphere and recovering heat from the distillate and concentrate carrying out wastes as they cool down to room temperature completes the system.

FOR A SEA-LEVEL CANAL

The present lock system of the Panama Canal cannot be protected against bombing, and John G. Clayburn, superintendent of the Canal's dredging division, has urged that the waterway be streamlined to make it a sea-level route between oceans. Such a project would take twelve years to construct at a cost of $1,310,000,000.

Mr. Clayburn believes that the invulnerability of a sea-level canal has been amply demonstrated at Suez, which was blocked by sunken ships during the war but only for a few days at a time.



The MIT-Sperry Detonation Indicator is an engine instrument which immediately detects and evaluates detonation. This positive warning of improper combustion—with the Sperry Detonation Indicator on the job from take-off to landing—assures optimum engine performance with the *certainty* that the engine and fuel are properly matched at all times. Furthermore, it is also of value in critical operations involving antidetonant fluid injection.

New gains in serviceability, dependability and life are achieved by the latest Sperry Detonation Indicator with improved Pickup and Commutator. Superior coil construction gives twice the former output signal and longer Pickup life. In addition to increased life, the new Commutator has the tested advantages of simpler installation and timing, easier and less maintenance.

DEPENDABLE SPERRY PICKUP

The MIT-Sperry Detonation Indicator is designed for use on all types of engines and aircraft. It is a particularly valuable aid in engine operation, design and testing—or in the development of engine fuels. Let us give you complete information on this improved engine instrument.

Sperry Gyroscope Company, Inc.

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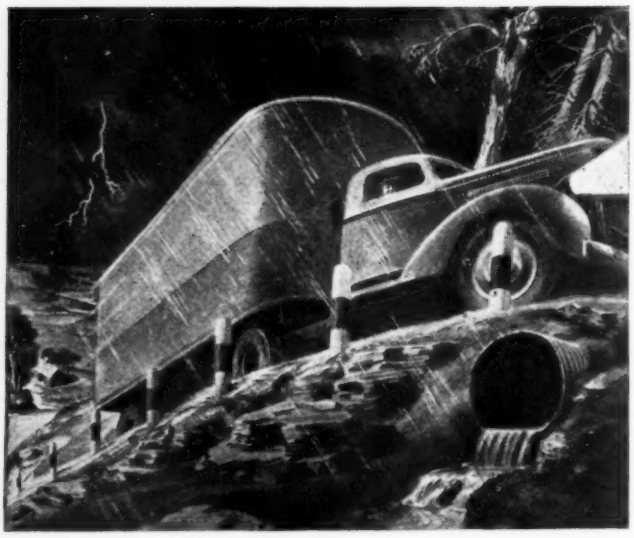


There must be no compromise with --Safety

Warner Vari-Load Electric Brakes are Safer!

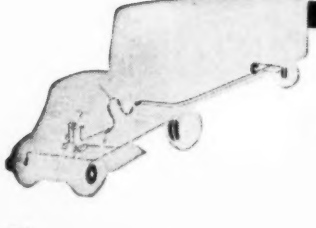
TODAY, America is depending on motor transportation as never before. Every pay load carried by big trailer outfits must get through on schedule. Delays due to accidents caused by ineffective brakes must be prevented—there should be no compromise with *safety!*

It is significant that 80% of all power-brake equipped trailing vehicles purchased by the Government during the war—*had Warner Electric Brakes.* So take a tip from Uncle Sam—protect your drivers, your cargoes, and your trailer outfits—give them the EXTRA SAFETY of *Controlled Braking Power*—exclusive feature of Warner "Vari-Load" ELECTRIC Brakes. No matter what the weather, the driver can pre-set any and all brakes to fit BOTH load conditions and road conditions—thus keeping his train straightened out and under full control even when the going is slippery, and avoiding costly tie-ups due to damaged equipment.

On all future trailer purchases, specify Warner "Vari-Load" *Electric* Brakes—world-famous for safety, simplicity, and dependable, efficient, trouble-free performance.

WARNER ELECTRIC BRAKE MFG. COMPANY
BELOIT, WISCONSIN

WARNER
ELECTRIC BRAKES



Only a few flexible wires. Nothing to freeze or chatter—no complicated mechanisms.

New Developments

He contended that the locks and dams of the Panama Canal were vulnerable to bombing, and that the destruction possible with an atomic bomb would make it virtually impossible for our engineers to repair the Canal once it was bombed.

SAFE INSTRUMENT APPROACH SYSTEM

Radio signals from five transmitters—one of the most complete instrument approach systems for aircraft landings in use at a major airport—now guide pilots through fog or storm for safe landings at Lockheed Air Terminal, Burbank, Calif. The network of radio beams and marker signals ensures safe landings in inclement weather and speeds up operations.

The radio beams are not a blind landing device. They direct approaches to the airport runway through bad weather for visible, or contact, landings by use of standard radio navigational beam signals universally recognized by airline pilots. A unique feature of the automatic installation is a pullout system that enables a pilot to pull away safely from the airport should he be unable to land after he has made his descent to 600 feet.

AIRCRAFT STATIC ELIMINATOR

Static, the bane of aircraft communication, is now being combated with an artificial drizzle of electrically charged droplets. A recently patented device provides three or more long rods or trailing wires from wingtips and tail, together with a larger number of short metallic fingers, all connected together but all insulated from the plane itself. This system is calculated to pick up an electric charge from the air directly to the rear of trailing edges.

Curved over toward these fingerlike projections are nozzles conveying a liquid from a reservoir within the plane. They are filled with wicks and so adjusted that droplets of the liquid can be released in controlled small quantities. This liquid carries a charge of the same sign as that of the plane itself, while the trailing fingers and rods are oppositely charged. Therefore each droplet carries away with it a small fraction of the plane's static charge, which is neutralized when the droplet is attracted to the trailing metallic system.

VACCINE AGAINST DENGUE FEVER

An effective vaccine has been obtained against dengue fever, it was announced recently by the Commission on Neurotropic Virus Diseases of the Army Epidemiological Board. The fever virus first was isolated in Hawaii by army doctors and brought to the United States where it has undergone thirty-two consecutive passages through the brains of mice. In the course of these passages it underwent a curious mutation whereby it lost its capacity to produce in men the severe illness and protracted fever characteristic of the original disease. It has retained, however, its ability to produce the measleslike rash, and it gives subsequent immunity to the unmodified dengue virus. The immunizing dose is very small. The extract from the brain of a single mouse has been found to contain at least 10,000 such doses. The new vaccine is prepared from this modified virus.

THE B-50, NEW SUPERFORTRESS

A new superfortress—the B-50—with more power and better flight performance than the B-29 has been announced recently. An experimental model has been tested since 1945 under the supervision of the Air Technical Service Command and the Pratt & Whitney Aircraft Division of United Aircraft Corporation. A production version is now being built by Boeing Aircraft at Seattle. The B-50 has four Pratt & Whitney radial engines with a total of 12,000 horsepower as compared with the B-29's 8,800. Observers said the experimental model left the ground at light bomber climb angles. Jet exhaust stacks help increase its speed.

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Deep-rooted in this Twentieth Century, Reo has borne its share of the heavy hauling load. The massive frames of the new Reos—cold-riveted for extra strength—the sturdy axles, springs and wheels are engineered for today's big building job. The powerful, precision-built engines are designed to deliver loads swiftly and at low cost. Also of interest to all truck operators is Reo More-Load design which provides more load space on shorter wheelbase, with balanced weight distribution and shorter turning radius. Reo is *all truck* in every part and every dimension. Get the facts and you'll standardize on Reo equipment, which is now being sold and serviced through a nation-wide organization of distributors, dealers and factory-operated branches. REO MOTORS, INC., Lansing 20, Michigan.

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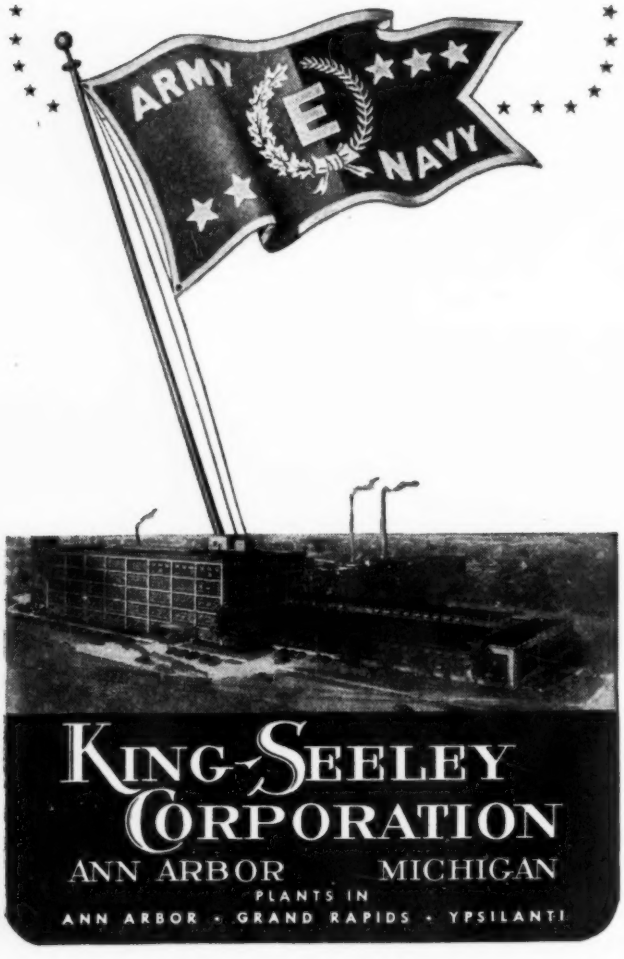
KING-SEELEY'S Service Record

The records show that between February, 1941, and August, 1945, King-Seeley employees produced and delivered to our Armed Forces more than 385,000,000 pieces of special war materials. In addition to this, more than 1,000,000 pieces of regular production items such as governors, gauges, and speedometers for both combat and supply vehicles were produced.

We feel justly proud of this record and the sixth Army-Navy "E" Award given us May 12, 1945, in recognition of this accomplishment. If necessary, we can do it again, but right now we are devoting all our energy to the production of peacetime civilian goods to the end that all may enjoy true prosperity.



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COMMUNICATIONS

UTILIZE PRIVATE RESEARCH

In the issue of ARMY ORDNANCE for September 1933 there appeared an article by me urging the use of private-enterprise laboratories for preparedness purposes. This was responded to in a subsequent issue by an Army officer who clearly dismissed my contention as unworthy of serious consideration. Since then we have been through a great war in which we have seen exemplified the notion that inexperienced unqualified men in uniform should be entrusted with noncombat responsibilities while experienced men qualified in the fields involved should not be utilized because they are not in uniform.

In the early stages of the war the laboratory with which I am connected was not used at all. In the later stages we were called upon for services beyond our ability to render. In the meantime we had lost several of our younger technicians. The whole inspection field was handled largely by men in uniform, even where competent civilian ability was available.

My objection to the point of view of the military in these matters may be illustrated by the experience with the "dimout" in coastal areas. We were invited to assist the Engineer Board in researches as to suppression of sky glow, and we cooperated with the Second Service Command in devising and applying dimout procedures hereabouts. Some part of our expenses was paid, but only a part. No fees reached us.

IN the matter of research, although on our staff there were unexcelled experience and ability, we were not permitted to participate in the planning or in the analysis of findings and the conclusions to be drawn from them. We were merely permitted to assist in making the measurements that had been planned and that were reviewed by those in uniform. We have not been permitted to see the final report on the subject.

In the matter of local dimout procedures we were not utilized for assistance in preparing regulations and only to a limited extent for assistance of those enforcing the regulations.

This may be contrasted with the British procedure. In England, with a much more critical situation than we ever encountered, the best ability of the country was marshaled in the service of the nation. The Ministry of Home Security placed military assistance at the disposal of these experts. The studies of the blackout situation made under such auspices were of outstanding competence. Through the British Central Scientific Office in Washington I was permitted to study the findings, although I have not been permitted to see the like American report.

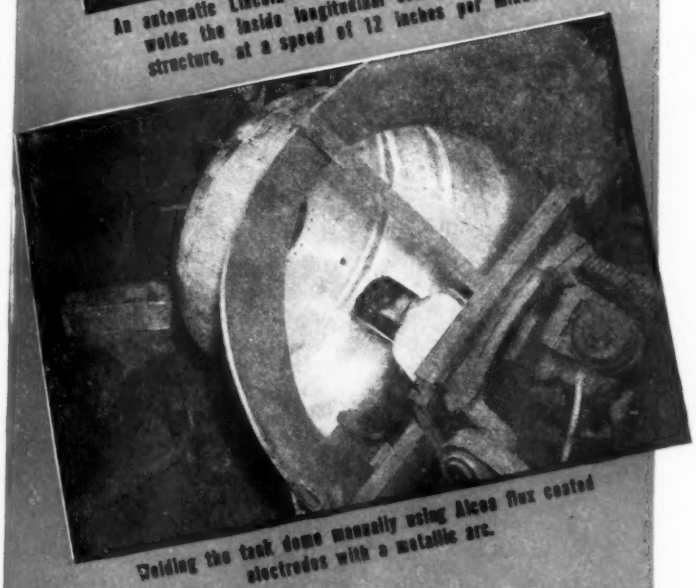
The foregoing is not intended as a complaint. My purpose is to suggest that if it is at all possible there should be brought about a review of military policies in the hope that, in further preparedness, provisions will be included for utilization of the best available civilian talent on all technical problems in which civilians might properly function.

From my point of view, the country would be better served if tests and inspections were made, so far as practicable, by the organizations that in peacetime specialize in such services. And when there are technical problems for which there is available outstanding civilian ability, that ability ought to be used in the national interest without the hampering influence of military red tape.

New York City. PRESTON S. MILLAR

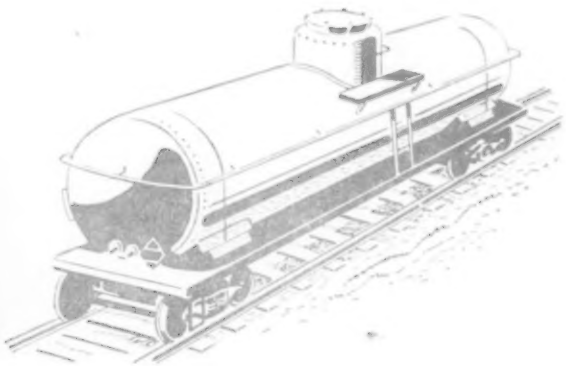
About 50 all-aluminum tanks for tank cars are now being built by General American Transportation Corporation.

An automatic Lincoln "Electronic Tornado" carbon-arc welds the inside longitudinal seam of the shell structure, at a speed of 12 inches per minute.



Welding the tank dome manually using Alcoa flux coated electrodes with a metallic arc.

They're *Welding* All-Aluminum Tank Cars



Aluminum tank cars are now a "production" item. About 50 are being built or are on order by General American Transportation Corporation of Sharon, Pennsylvania. And speeding that production is Lincoln Electric Company's "Electronic Tornado" automatic carbon-arc welding machine.

Each shell—31 feet long by 78 to 87 inches in diameter—is made up of ½-inch and ⅝-inch Alcoa Aluminum plate. Alcoa Alloys are used because of their superior performance in the presence of the chemicals to be hauled in these cars.

Whether you've a question on *how* to employ aluminum to best advantage, which fabricating methods to use, or what alloys, Alcoa can help determine the answers. For such assistance, call the nearby Alcoa office, or write:

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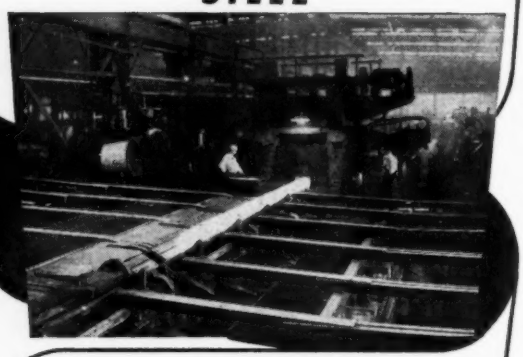

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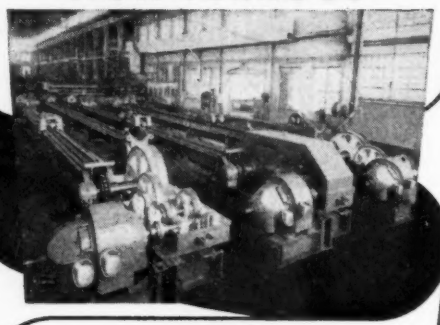

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From The Record

NAVAL SUICIDE AGAIN?

Until firm foundations are laid guaranteeing world peace, we must assume that there will be aggressors and that those aggressors will have to be curbed by force. Whatever international agreements or associations may be sponsored by the United Nations, one of the cornerstones of peace must be the maintenance of armed force by the United States; particularly the sea and air power of the U. S. Navy.

In the past, at the end of every war, during some of which our naval power was built to formidable proportions, we invariably destroyed that power or let it rot.

We ended the first World War with a very respectable Navy afloat, with more ships building, and with a fair prospect for an adequate number of Pacific bases. But in 1922 we initiated the Naval Disarmament Conference which resulted in treaties that caused us to sink twenty-five per cent of our fleet, to stop building additional ships, and to accept other limitations on our future naval program.

Some of the things we did under the terms of the treaties and under subsequent agreements seem unbelievable now. *We scrapped or sank 30 battleships, including 7 partly completed new ones, and junked 15 cruisers, 139 destroyers, and 52 submarines.*

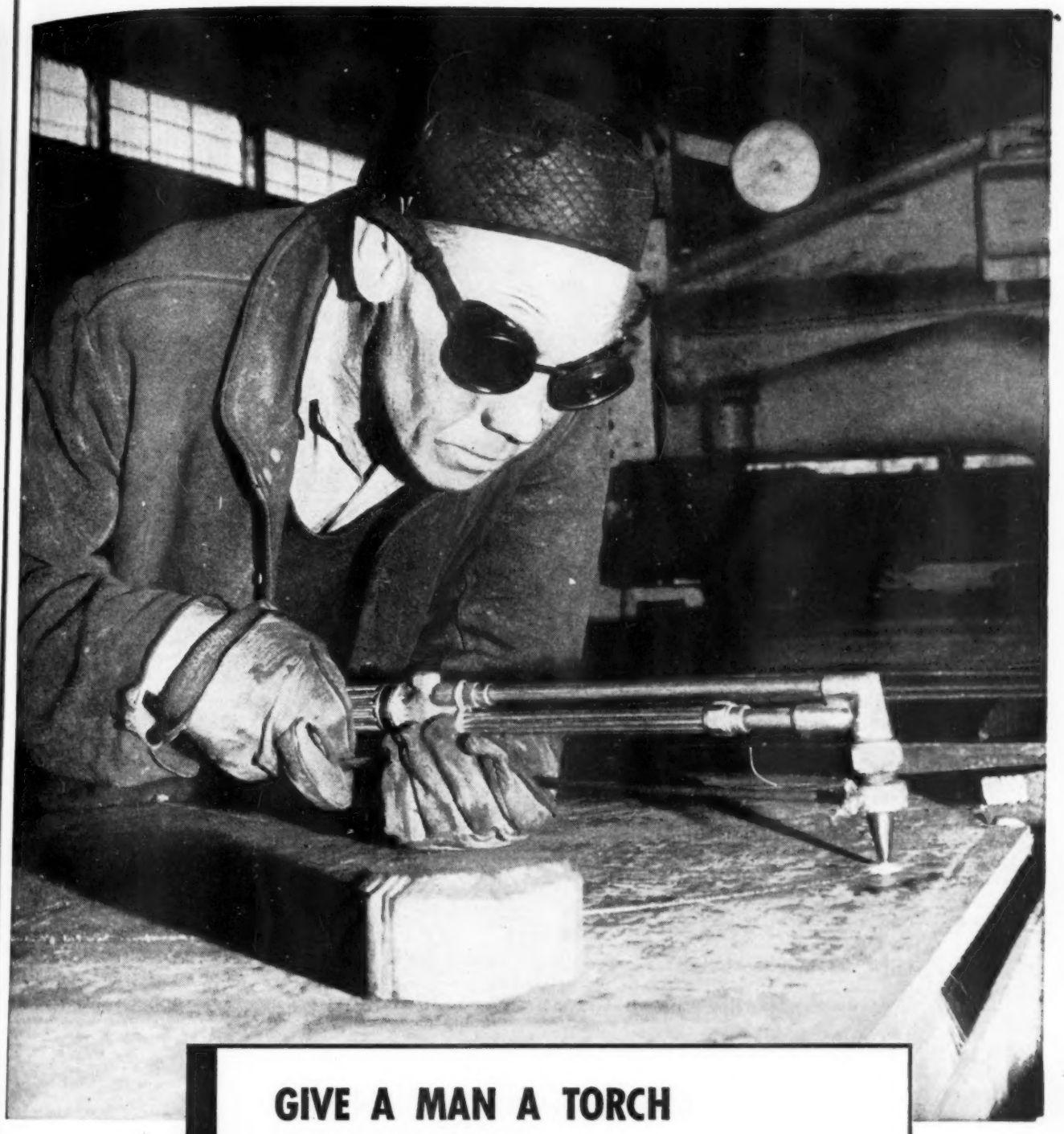
Some of those vessels were the newest and best of their kind. Naval officers still wince at the recollection of the WASHINGTON, a good fighting ship seventy-five per cent completed, being towed to sea and sunk by our own guns and torpedoes on November 25, 1924. While we saved two partly completed battle cruisers which were later converted into the aircraft carriers LEXINGTON and SARATOGA, we tore up four sister cruisers which would have made equally good carriers—and four more carriers would have been a vast comfort in 1942.

The 1922 treaty limited our naval air strength to 135,000 tons of aircraft carriers, with a restriction of 27,000 tons on each new carrier. Result: we are just now building the 45,000-ton carriers needed to step up the power of our air strikes from the sea. Similarly, new battleships were limited to 35,000 tons each, which prevented construction of the new 45,000-ton superships of the present IOWA class.

In the 1930 treaty we accepted a ceiling of 18 cruisers with guns larger than 6.1 caliber. The result: a limiting factor in the early days of the war. We also accepted a limit of 150,000 tons for destroyers, and agreed that no one could build any other surface warship between 600 and 2,000 tons if that vessel carried torpedo tubes or had a speed of more than 20 knots. This last almost unbelievable restriction was serious, because it prevented construction of antisubmarine vessels. German submarines travel on the surface at 18 or 19 knots and some may exceed 20 knots.

IN retrospect, it is plain that we lightly gave away in these treaties the means by which we could have kept the peace of the world or, at any rate, by which we could have swept any aggressor from the seas. And not only did we sink part of our Navy and hamstring the rest, we also discredited the industries and individuals upon whom we relied for ships and guns and aircraft. During the '30's the armaments industry was hit broadside by a wave of "merchants-of-death" criticism.

As a result, the Bethlehem Steel Corporation, which had the



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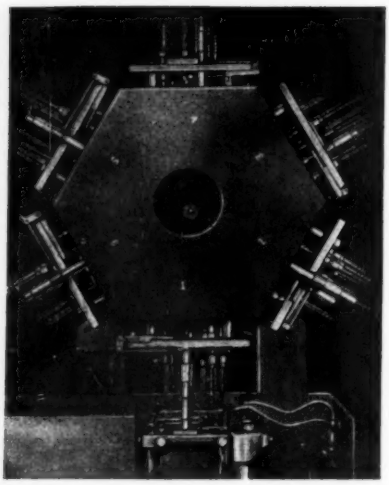

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Savings in labor and expense are not confined to improvement in manufacturing technique. Savings are being made in office work, too!

Today, ONE National machine and ONE operator can do the entire bookkeeping and accounting job in a plant employing 50 to 200 people. Instead of having to use different machines, the following accounting and bookkeeping work is done in industries employing up to 200 people on ONE National machine by ONE operator, swiftly, accurately, and economically.

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- Posting Employees' Earnings Records
- Posting War Bond Records
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Whether your factory is small or if you employ several thousand people, it will pay you to let a National representative make a survey of your present accounting methods. Do not change them unless he proves to your complete satisfaction that a definite saving in time and money can be made.

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From the Record

finest big-gun-forging units in the world—its only rival was the Krupp works of Germany—scrapped that forging capacity almost entirely. The Navy had to rehabilitate it in 1940 at a cost of $2,500,000.

Du Pont, one of the world's largest manufacturers of explosives, tried to divest itself to a large extent of its facilities for making powder and continued to manufacture explosives only at the urgent request of the Army. . . .

We undermined our potential power in a third way by our indifference to military geography. At the time we acquired the Philippines, we could also have bought from Spain the Mariana, Caroline, and Palau Islands for about $4,500,000. We took only Guam, in the Marianas. Germany bought the rest—which were mandated to Japan after the first World War.

Thus by inertia we accepted a fatal limitation on our freedom of action in the Pacific. We failed to realize that without an adequate bridge of bases across the Pacific we could not defend the Philippines or support our open-door policy in China. In other words, while continuing to assert an opinion and influence in Asiatic affairs, we denied ourselves the military means to operate effectively in the Western Pacific.

During the past four years we have become the greatest sea and air power on earth. We have added to our fleet 9 battleships, more than 70 aircraft carriers, 34,500 planes, a score of cruisers, more than 500 destroyers and destroyer escorts, over 100 submarines, and thousands of landing craft, auxiliaries, patrol and mine craft.

We had time to turn out these ships and planes—time gained for us by England's single-handed stand against the Germans in 1940-1941, and by the mighty resistance of Russia. Next time there may be no such breathing spell. In the next war, the enemy may be over our homes on the first day of hostilities.

What shall we do with these sea and air armadas that we have built and are still building? Shall we destroy them again and go back to the dream that geography insulates us from war? The peace of the world and our own security demand that we retain the relative superiority in sea and air power.—*James Forrestal, Secretary of the Navy. Reprinted by special permission of the Saturday Evening Post. Copyright 1944 by the Curtis Publishing Company.*

STRENGTH FOR GOOD WORKS

I believe that strength is necessary in support of good works, just as strength has been applied in the furtherance of wicked aims in the world. We gained a great victory over the Axis powers in this war, but there are still enemies abroad, external and internal, because when you come down to it, the seeds of war are in the breast of each of us. None of us, as a citizen or as an official of his government, can escape his responsibility for understanding that within him is a certain amount of greed, a certain amount of selfishness, a certain amount of prejudice. Those things are not going to be eradicated from our breasts within our time; but we can find ways to control them, to turn them to practical use, so we can get along together.

In this great world problem I think that the Americas have an unusual opportunity. I believe that in the Americas more than in other countries are still remaining those shreds of the pioneering spirit that brought our forefathers into every country of this hemisphere from Europe. They did not have some one to take care of them. They had to take care of themselves. That pioneering spirit, that determination to go and live their lives as they please which, as I understand it, is at the basis of our understanding of democracy, is still with us in great measure.—*General of the Army Dwight D. Eisenhower before the Inter-American Defense Board.*

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German Guided Missiles

NAZI SECRET WEAPONS DISCLOSED

A number of hitherto secret German guided missiles were disclosed recently at Farnborough, England, as reported in *The Aëroplane*, and some of the new-type weapons are discussed here.

Designed by Rheinmetall Borsig, the *Rheintochter R1* was developed as a ground-to-air weapon for operation with the Rheinland system of aircraft interception, in which two radar plots, one on the hostile airplane and the other on the projectile, were correlated by a ground controller.

The Rheintochter R1 consisted of a rocket-propelled missile with six wings, aft of which was a booster rocket with four fins. The booster rocket was used for launching, and after expending its energy it dropped off. The distance from the launching base at which the booster rocket left the main missile was about two kilometers.

The main rocket had a fuselage measuring 11 feet, 10½ inches in length, and 20 inches in diameter. Just aft of the pointed nose were four wooden control fins connected to operate in pairs, the top and bottom fins controlling the direction of flight and the lateral fins acting as elevators. The rocket motor was located just forward of the wings, and the exhaust gases were released through six venturis spaced round the fuselage between the wing roots. These venturis were inclined outward to ensure that the gases cleared the booster rocket unit.

Of mixed wood and metal construction, the airfoils had a very thin section. Leading edges were of wood, while the sections aft of the thickest part were made up of a solid wooden core covered with thick sheet metal. These wings had a root chord of 28 inches, a tip chord of 10 inches, and the sweep-back on the leading edge amounted to 40 inches. The total span was 8 feet, 8 inches. The war head was situated in the extreme tail aft of the wings.

The booster unit consisted of a cylindrical fuselage 58½ inches long and 22 inches in diameter. It contained a rocket motor and mounted four all-wood fins. These fins had a root chord of 32½ inches, a tip chord of 12 inches, and a total span of 7 feet, 3 inches. The exhaust gases were ejected through five outlet tubes in the extreme rear. These tubes had a maximum diameter of 7 inches and a length of 7½ inches. Two additional tubes, upper port and lower starboard, were sealed off.

RHEINTOCHTER R1 was launched from an inclined ramp. Small holes in some of the main wing tips suggest that some form of launching runner had been fitted. A flare in the tail of the main rocket was used as a visual aid for steering. Development of this weapon had ceased prior to May 1945, but an improved version known as the R3 had appeared. The total length of the R1 was 18 feet, 10½ inches, the maximum speed 1,500 to 1,600 feet a second, and the maximum ceiling 20,000 feet.

An interesting point about the German development of air-to-air and ground-to-air weapons was the way in which aircraft designers were brought in to design missiles. Henschel was given a range of types to design, including Hs 293 and Hs 298, Messerschmitt designed the Eizian (Gentian), a 4-rocket missile similar in outline to their Me 163, while Junkers produced the Schmetterling. Schmetterling was designed by Professor Wagner, of Junkers Flugzeug und Motoren Werke, and this weapon bore the distinctive title of V-3.

Schmetterling was a radio-guided, rocket-propelled antiair-

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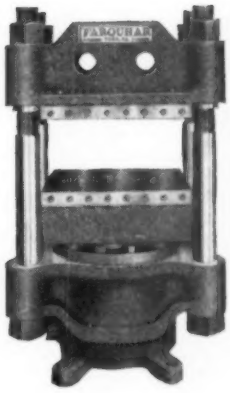

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German Guided Missiles

craft missile. In layout it comprised a long cylindrical metal fuselage with a short-span midwing placed far back, with a cruciform tail unit. The fuselage was built in sections housing the components and was covered with a metal skin. The nose was asymmetrical, the port side carrying the long fuze and war head and the starboard side having a 6½-inch 4-blade airscrew driving the electrical services.

The wing was an extremely interesting structure, being cast in one piece including the main spar, trailing edge, and six main ribs. Attachment was by means of a tubular spar passing through the fuselage and inside rib to a point at the junction of the nose of the third rib and front spar. The whole structure was covered with a light-alloy skin, and lateral control was achieved by spoilers on the trailing edge. The cantilever tail unit was also cast and covered with light alloy. Spoilers were fitted to the trailing edge of the tailplane, but no true directional control was provided.

Ground launched, Schmetterling was propelled by two rocket motors, one attached to the top of the fuselage and the other beneath the fuselage. These units gave tremendous thrust for a short period and when expended were automatically jettisoned. Schmetterling was to have homed by radio on bombers by acoustic and sighting devices. Professor Wagner believed this missile to be so accurate that he predicted that one bomber would be destroyed for every missile fired. This weapon was ready for quantity production.

WASSERFALL was a ground-to-air rocket missile generally similar in conception to the larger long-range A4 rocket. The exhibit at Farnborough was actually a small model of this weapon. It was painted leaf green and still had traces of earth clinging to it, which was explained by the fact that this particular specimen had been obtained as a result of dragging a pond near Nordhausen.

Externally, the Wasserfall is almost identical to the V-2, but has four short-span wide-chord wings, and it appears to be related to another weapon found in the American zone of occupation in Germany just after the German collapse. This other type had only two wings of a higher aspect ratio and a modified tail unit.

Wasserfall was propelled by visol and nitric acid and was originally designed to be detonated by a radio fuze. Later models would probably have been detonated by a proximity fuze in conjunction with a homing device. The early models of Wasserfall are known to have been fitted with a Siemens K12 automatic pilot servo unit, used to actuate the control surfaces of the weapon.

One of a series of air-to-air, ground-to-air, and air-to-ship weapons produced by Henschel was the *Hs 298* shown at Farnborough. The Hs 298 was described as a radio-controlled glider bomb, but, as in the case of the Hs 293, which also carried this description, the Hs 298 had rocket propulsion.

Hs 298, a small and ugly missile, was designed for use against bomber formations. It was released from a parent airplane flying a little above or below the target at a range of a half to 1½ miles. The stipulation that the Hs 298 was to be launched from above or below the target was probably to help in aiming the missile as it would be more easily guided from these positions.

Experimental work was begun early in 1944 and was not completed by the time of the German collapse. Control was achieved by spoilers on the tailplane and wing tips. The missile was exploded by a proximity fuze.

Data: Span of wing, 4 feet, 2¾ inches; chord of wing at root, 19½ inches; chord of wing at tips, 9 inches; sweep back on leading edge, 18½ inches; length, 6 feet, 7 inches; width of fuselage, 7½ inches; maximum depth of fuselage, 16 inches; span of tailplane, 21⅛ inches; total weight, 210 pounds.

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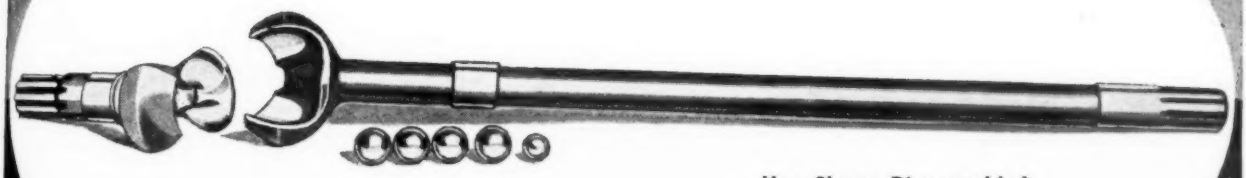

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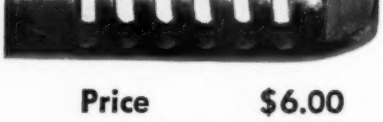

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FEATURES

The New Artillery . . . . . Frontispiece
The Ordnanceman 33
The Road to Peace 34
GENERAL OF THE ARMY DWIGHT D. EISENHOWER
Can We Learn from War? 36
JOHN M. HANCOCK
Two New Army Airplanes (Pictorial) 38
Personalities and Strategy 39
HOFFMAN NICKERSON
Maj. Gen. Everett S. Hughes 41
Choose Your Weapons, America! 42
MELVIN M. JOHNSON, JR.
Is the Sky the Limit? 45
DR. FRANK J. MALINA
Focus on the Atom (Pictorial) 49
Plowshares to Swords 53
Army-Navy Ordnance 55
VICE ADM. G. F. HUSSEY, JR.
Industry-Ordnance Leaders (Pictorial) 58
Sighting Stations on the B-29 60
G. A. COOK
Universal Training for Peace 62
COL. JOHN G. BOOTON
Industry in World War II 65
COL. CLYDE H. MORGAN
Ordnance Roll of Honor 68
New Field Weapons for the Army (Pictorial) 70
Industry in the Confederacy 71
FRANK E. VANDIVER
Month by Month 73
Hemisphere Security (An Editorial) 75

DEPARTMENTS

New Developments . . 12
Communications . . . 22
From the Record . . 24
German Guided Missiles . 28
Association Affairs . . 76
Let's Look Ourselves Over 80
E. B. GALLAHER
Professional Digest . . 81
Ordnance Directory . . 84
Book Reviews . . . 92
Index of Advertisements . 99

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The unusually large number of manuscripts for publication in ARMY ORDNANCE received in recent weeks prompts us to discuss here briefly some of the editorial policies of ARMY ORDNANCE on this score. It is a sign of good health that readers and prospective authors are so interested in the contents of these pages.

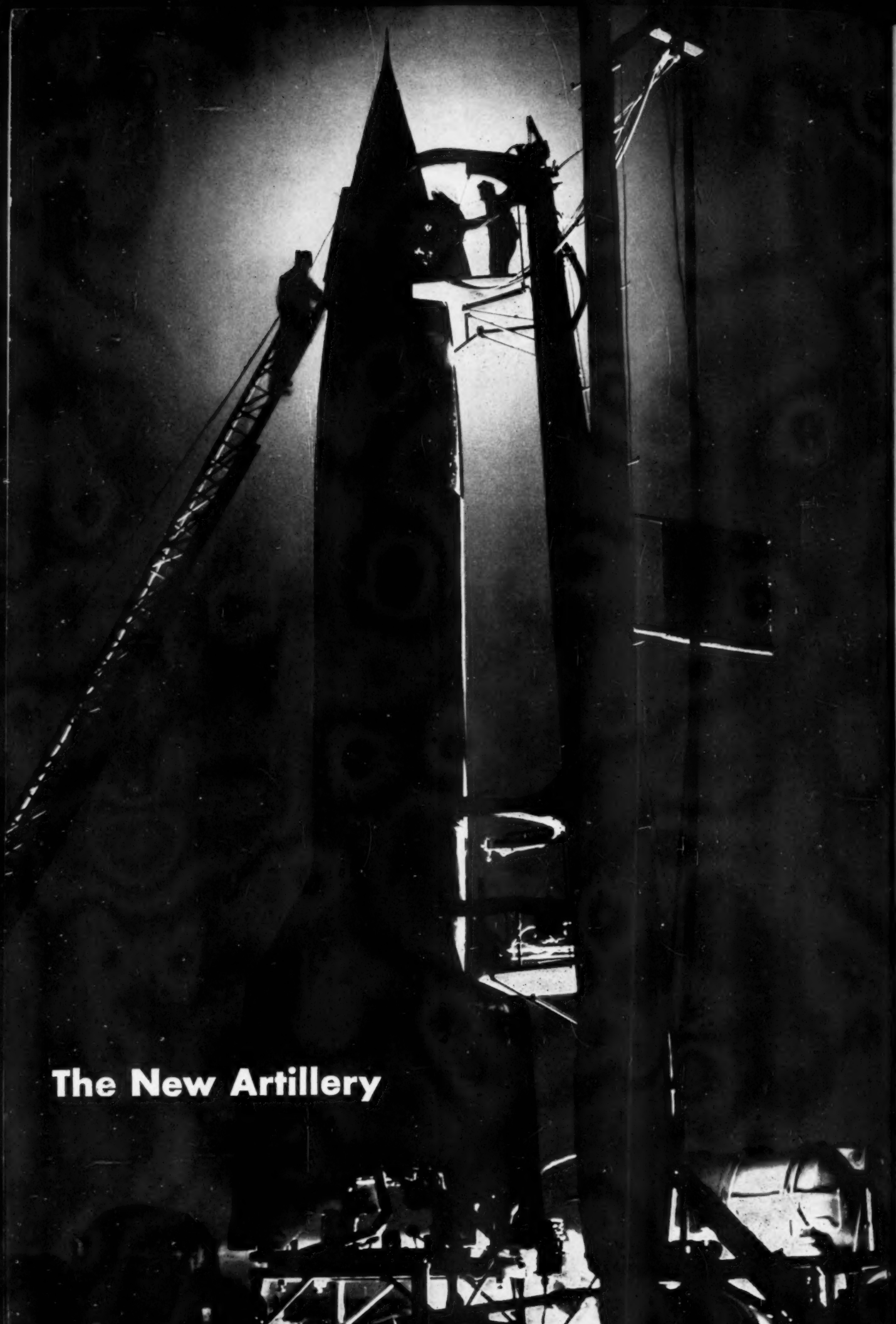
We are proud of this condition. It will sustain us in our determination to do everything within our power to increase the value and effectiveness of this journal for the advancement of our national defense.

We are particularly anxious to cultivate authorship among the younger members of the Army Ordnance Association. There are literally thousands of members who are especially qualified to present their analyses and conclusions on ordnance subjects based on actual training and experience.

These members have served either in the military service and are therefore qualified to write from the viewpoint of actual design, supply, maintenance, and use of our ordnance; or else they served in civilian capacities here or abroad and are competent to write about the industrial phases of arms procurement, production, and supply as well as the problems of management, costs, and technological advancement. To them all, the latchstring is out.

What we are determined to do in these pages is to make them readable. Therefore, manuscripts where possible must be brief, to the point, and not overspecialized. The greatest problem facing Ordnance preparedness in our country in the years ahead is to maintain interest in all phases of a ramified subject. As things look to us, that interest will be maintained only when such a journal as this talks facts and presents conclusions fearlessly, so packaged that the average American citizen will read and take them to heart.

—The Editors



The New Artillery

The Ordnanceman

A Tribute to the GI's Contribution to Global Victory

THE Nation owes the "brass," combat and noncombat officers alike, a tremendous debt of gratitude. We as a people can never be too generous in heaping honors on the men who led the forces ashore, afloat, and aloft. On equal footing we place the leaders of the industrial effort in laboratory, arsenal, depot, and factory. They provided the planning, leadership, and inspiration for the greatest military-industrial effort in the history of the world.

But without in any way detracting from their proper glory, we think it appropriate to spotlight the vast number of noncommissioned personnel, especially Ordnance enlisted men, who served their country with the same zeal and efficiency as the brass hats but have thus far been denied, except in family circles and in a few communities, their full mead of praise and appreciation. Typical of this great company is Ordnance Sgt. Benjamin F. Cheydleur, whose portrait appears on the front cover of this issue.

The contribution of the Ordnance enlisted man to global victory has been outstanding in four major fields—maintenance, logistics, reclamation, and research and development. Ordnance technicians accompanied our combat forces every dusty mile across North Africa. They kept our trucks rolling and our ground and aircraft guns firing. They worked in hastily improvised repair shops behind the front; they set up mobile shops in the field; they were in the front lines and frequently took part in the actual fighting. They serviced all automotive and combat equipment preparatory to the invasions of Sicily, Italy, and western and southern France. In the Far East they rendered heroic service on Bataan and Corregidor and took part in every amphibious operation from Port Moresby to Okinawa.

Equally handy with a grease gun or a bazooka, Ordnance technical specialists replaced broken crystals in wrist watches and rebuilt General Sherman tanks. By their skill, courage, and unfailing ingenuity, they made it possible for our combat forces to strike back at the enemy and to maintain an aggressive global offensive with an ever-increasing volume of deadly firepower.

During the European campaign, 21,000,000 tons of supplies of all kinds were discharged in European ports, approximately 4 times as much as the 5,418,238 tons unloaded in Europe during World War I. Ordnance logistics began in U. S. depots. There shipments were prepared for combat stations in all parts of the world, for our own troops and for the fighting forces of more than forty allied nations. More than 2,000 different kinds of equipment and ammunition, and approximately 700,000 different types of spare parts were packaged for overseas shipment.

In foreign lands, Ordnancemen established great depots and warehouses to receive and store American shipments. They devised a supply system to transport huge tonnages of supplies right up to the constantly changing battle fronts.

THE reclamation of a thousand tons of damaged Ordnance matériel a day is a billion-dollar-a-year business. Reclamation is a combination of recovery, rehabilitation, and repair by which unserviceable or battle-damaged equipment from global beachheads and battlefields is gathered up and repaired locally or shipped to the United States for remanufacture and reissue to troops. For the year 1944, Ordnancemen returned to supply channels major items valued at $858,000,000, component parts valued at $200,000,000, and approximately 600,000 vehicles. These figures do not include the renovation of countless rounds of ammunition.

Ordnance technical specialists, both in the United States and overseas, were encouraged to work out ways and means of improving existing methods, techniques, and matériel. They responded with a host of valuable ideas that were quickly incorporated into Ordnance procedures and combat equipment. The boys who loved to tinker with the family car and make model airplanes devised new training methods, new mechanical gadgets for trucks and tanks, new sighting and other aids for rifles and bazookas, and, in the case of Sergeant Cheydleur, new time-saving methods for estimating the target damage of our air-borne weapons, including the atomic bomb.

Tech. 3rd Grade Benjamin F. Cheydleur, Ordnance technician, was awarded the Legion of Merit recently for developing and testing time-saving machine methods of complex calculations used in target-damage studies which were used to estimate effectiveness of the atom bomb and other air-borne weapons.

Sergeant Cheydleur's calculating service was developed in 1945 to determine sampling coefficients from photographs taken of bomb-damaged areas in the European and Pacific theaters. His studies contributed largely to the success of the National Defense Research Committee in estimating damage that could be expected in future raids from each type of bomb and the relative effects of various weapons against industrial targets. From these studies and certain experiments it was possible to predict the effectiveness of the atomic bomb.

These calculations will be made in connection with the possibilities of short-cut techniques of atomic fission. It is expected that the machine methods of calculation developed by Sergeant Cheydleur will be of greatest assistance in the solution of complex problems of technical and scientific nature.—The Editors.

The Road to Peace

American Scientific and Industrial Preparedness Will Lead the Way

by

General of the Army
Dwight D. Eisenhower

"Idolatrous worship of weapons because of their bigness or destructiveness can jeopardize a security program that is not keyed to the future through continuing research."

IT is now more than a year since the German High Command came to my headquarters in the schoolhouse at Rheims to sign the documents of unconditional surrender. Because that day was hastened by this area's production of the impedimenta of war, I am particularly pleased to have the opportunity of meeting with the members of the Michigan chapter of the Army Ordnance Association. You and this city hold a place high on the honor roll of war work. Through you and the men and companies associated with you was administered more than half the total dollar value of the Ordnance Department's procurement.

To me, your group represents two things: One, the power and flexibility of the American industrial plant; the other, the intimate relationship between civilian effort and military strength. In the first point is one source of the victory and world leadership that our fighting men won for us. In the latter lies the key to our future security and our ability, with the other nations, to build a lasting peace.

In 1941 we were attacked because our immediate military weakness led aggressors to discount the possibility of an effective reaction. Against us were arrayed powerfully armed enemies who for many years had been engaged either in war or preparation for war. We overcame their seemingly insuperable advantage and became an arsenal for the allied world.

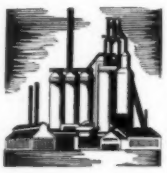
This we could do because the necessary time for rearmament was furnished us by the heroic resistance of our allies and because the men and women of Detroit and other American industrial centers, workers and management, scientists and engineers, political leaders and technicians, combining their brawn and skills and techniques abandoned their peacetime endeavors for a gigantic effort to arm against the aggressors.

The Germans have excused their defeat by the claim that we won merely a technological victory through the possession of cities and production centers like Detroit, with men and women highly skilled in production processes. In part, that is true. The weapons of war came to us in the field in such numbers that the allies were able to bury the enemy under weight of metal, to hit him with a crushing punch, to slash and cut his armies with terrific speed. We were in a position to sacrifice metal to save American lives.

THE statistics of your production are known to all the world. Repetition by me would add nothing to their impressive and staggering proportions. But the flexibility of your productive effort remains a cause for wonder. Detroit, that to most of us before the war meant only trucks and automobiles, came to mean, in war, practically everything that we needed to defeat the enemy.

The Detroit area had no corner on technology and production. Throughout the United States all our production centers contributed to our victory. But Detroit is a symbol of the strength our enemies came to fear.

But the excuse of the Germans for their latest defeat is far wide of the full truth. The heroism and sacrifices of our fighting men formed the real spearhead of our victorious organization. The feeble Nazi excuse is refuted by many instances when, outnumbered and outgunned by the enemy, our men won through to victory. Moreover, there was more to our outpouring of weapons and equipment than mere material power to produce. There was the American spirit and American unity of will.



We proved that a free people, operating within a free economy, can achieve a teamwork, an integration of every material and human resource of the Nation, such as no totalitarian power can attain—that was the essence of our victory. The strength we derived from such unity in time of war is the sort of strength we must preserve to save us from future war.

The victory that national teamwork won for us now provides an opportunity to build a world ruled by law, rather than by brute force. Effort and energy and sacrifice are required of all if we are to gain our goal.

A lasting peace does not emerge spontaneously from the unconditional surrender of an enemy or even from the firm settlement of boundary disputes or the signing of peace treaties. All human experience underscores the obviousness of that fact.

Our national security is a first and essential step toward lasting peace. Democracy must have a firm base—to use a military expression—from which to project its ideals and benefits to others who may be groping or undecided in the adoption of governmental systems. We are an example to the world of the possibilities of democracy—weakness is likely to inspire contempt or disdain, rather than a desire to emulate.

In order to stand securely in the world as the fearless but understanding champions of liberty, we must draw on all civilian resources which can contribute to the country's defense. Coöperation between all the agencies of government, between all the economic and industrial and scientific and social agencies of our Nation is essential.

The Army, as one of the main agen-

General Eisenhower was the guest of honor and principal speaker at the spring meeting of the Michigan Post, Army Ordnance Association, at Detroit on June 3, 1946. This is his address on that occasion when more than 1,600 members were present.

cies responsible for national security, recently adopted measures to extend such relationship. By the establishment of the General Staff Division for research and development, the War Department has taken a further step toward the continuing application of national scientific resources to the solution of military problems.

Full success in the Division's mission requires civilian assistance in military planning from industrialists and scientists working in the greatest possible freedom to carry out their research. Security is not measured by the number or weight of guns alone, the armadas of planes that can be put aloft, or even the temporarily exclusive possession of the atomic bomb. Security is not static. Military stockpiles can become junk because of a single scientific development, and the security they lend can be wiped out by a single laboratory experiment.

Idolatrous worship of weapons because of their bigness or destructiveness can jeopardize a security program that is not keyed to the future through continuing research. The destructive power of a weapon is not necessarily the index to its combat effectiveness, now or later. Only close scrutiny by men qualified to evaluate all factors involved in the attainment of an objective can decide whether or not any specific weapon is the most efficient means to attain its given end. Only they can accurately suggest the lines along which exploration should be conducted for the development of a better weapon.

Unified effort by civilian and military agencies was the outstanding characteristic of our war effort. The measure of coöperation then achieved should not be considered the ultimate. Our national security depends on its continued growth. As you well know, research is not a commodity that the Army can buy at a quoted price and have delivered to its warehouses in properly sized and marked parcels. A weapon already in existence can be ordered, but research is a technique where results cannot be predicted.

MILITARY training does not prepare adequate numbers of men in that technique. Nor should the Army be forced to depend on its own efforts to develop the best guarantees of security, as long as we have at our door, within the democracy of which the Army is an essential part, the vast technical and scientific resources of civilian life. Cooperation between civilian and military agencies will assure us the finest in scientific research.

There appears little reason for duplicating within the Army any commercial research or manufacturing organization which, by its experience, is better qualified than the Army to carry out some of our tasks. A case in point is our world communications net which tied the theater commands to the War Department. Commercial interests make this type of communications their business and are organized to plan, engineer, and operate such a system. Peacetime coöperation would make possible the easy integration of these facilities in time of war as an organic part of the armed forces.

In general, the more use we are able to make of outside resources, the more energy the Army will have to devote to strictly military problems for whose solution there are no outside facilities or which for special security reasons can only be handled by the military. We need every resource for the thorough exploration of the wide fields that lie before us.

We have no monopoly on scientific talent. We do not control all the raw materials of research. We do not possess scientific facilities that others cannot duplicate. But we have all three in such measure that we can, through cooperative effort, maintain a national stature that will earn us continued international respect and prove a sound insurance against disaster in any future emergency.

I would like to stress, however, that our security program must be far more than a lopsided dependence on offensive and defensive weapons. Scientific effort and scientific research produces more than guns or shells or bombs. The social sciences, and the humanities also, play a dominant part in building a security structure and lasting peace.

Only by the development of our total national resources — intellectual and material, scientific and social, economic and commercial—can we have a firm foundation for our security structure. It must be based on a sound and healthy national life in which the individual citizen willingly sacrifices for the common benefit.

Progress in this direction will measure the value of our contributions to the whole problem of eliminating war. We cannot reach this goal overnight or attain it by any amount of wishful thinking. Only by the slow and thorough processes of education through every element of our people—of the world—can it be won.

You men here this evening can help immeasurably in developing truly American attitudes toward the problem of peace and by continuing to devote a portion of your research and development to our security. We do not need the largest standing army in the world —if we have the finest. We do not need to make our country a warehouse for war—if we develop techniques that obsolete weapons of aggression. The security of our country demands brains, not brute force; keen minds, rather than stockpiles of weapons. Above all it needs a partnership of the American people in which all our elements and all our enterprises shall coöperate.

Our forebears did not hesitate to put every ounce of their energy into the realization of their ideal—a free, prosperous, and united America. Because nothing could break their iron determination, they achieved their goal. Our ideal today is a free, prosperous, and coöperative world. Only if we are secure will we be free to work wholeheartedly and determinedly for this result, for in the presence of a deadly fear, logic, reason, and tolerance cannot live. National unity is the root of our strength—a truism we must not forget as we champion democracy and stand for justice in a united world.

"We have no monopoly on scientific talent. We do not control all the raw materials of research. We do not possess scientific facilities that others cannot duplicate. But we do have all three in such measure that we can, through coöperative effort, maintain a national stature that will earn us continued international respect and prove a sound insurance against disaster in any future emergency."

Achievements and Failures in Industrial Mobilization

Can We Learn from War?

John M. Hancock

THERE were tragedies in World War I which arose because we did not know. We were not ready. We had no dream of the size of the job we had to do. There were tragedies in World War II in that we didn't learn from the experience of the first war.

What should we have learned from that first war? What did we think we had learned? Wherein had we failed to carry conviction to the country—first to the Congress and, not less importantly, to the Chief Executive?

One thing we learned in the last war certainly might have been put in various ways. One man said, "We learned that the elements of war are the four M's—men, money, morale, and materials." Other men said, "It is the three M's. It is men, men, men." I stress the second concept because I think the quality of the men on the job is the over-all important factor in any war planning. That applies not only to the Army and the Navy but to civilian industry as well.

There cannot be any defense for the kind of mistakes that were made in World War I. If one wants to be soft-hearted he can say, "We had no idea of the size of the war. We had had fifty years of peace. Matériel became an important factor in war far beyond the capacity of man to understand and plan for." But the fact is simply that we had gone soft in both services.

We were afraid of men in industry in the last war. We had some reason for it, I think. The men in the services wanted to have authority and responsibility clearly outlined by statute or by executive order. Outside the services that was not thought of much in World War I. We were inclined to coast along and find out from the press who was the boss and who was the man who won the contest of strength. But after the lines of authority were laid down clearly, the services were in full support of the civilian agencies helping in the war effort.

Mr. Hancock is president of the Joint Board on Army and Navy Training in Industrial Mobilization.

Also in World War I we did not know what kind of men to seek. We went through this same kind of shaking-down process until Bernard Baruch and the rest of them in the super-agencies took over. In the prior war, as well as in this war, there had not been any attempt to find the kind of man to do the kind of job that had to be done. We had to go through this trial-and-error method and political battle until we finally found the man.

Pacifism was rife in this country. It got so far that it invaded the War and Navy Departments. That is a rather broad statement and may not seem quite right. Here to my mind is the proof: The question arose about the character of the war-mobilization planning and, in order to avoid public criticism, we stripped those plans down so that they would tell nothing and give no basis for an attack.

I AM not too critical when I say that. But we were politically minded. We had turned soft and pacifistic inside the two Departments. We did not seem to realize the importance of fighting out these issues in the press so as to have public support of our plans.

The job, as I see it, is to sell the concept of a mobilization plan to the Congress, to the Chief Executive, and to the country if necessary. But you cannot sell it by drawing back into your shell and being ashamed of your profession or ashamed of the job the armed services are to do in time of war. I could not quite say we were ashamed of it, but we did not know exactly what to do about it in the services, and many civilians also did not know. We just floated along with the tide, and military planning, outside the Army Industrial College, sank to a pretty low level.

I would like to suggest a reading of the report of the War Resources Board of October 12, 1939. This is the famous report which was suppressed by the Chief Executive at the time. In fact, it was ordered suppressed before it was prepared. The report itself was not so famous, but the fact that it was suppressed may have given it some notoriety.

In this period of uncertainty in both services regarding who was going to remain Secretary of War, Secretary of the Navy, Under Secretary of War, and Under Secretary of the Navy, the European conflict started. The War Resources Board was appointed in August 1939. The men on that board were under no instructions as to the time for filing their report. There was no sense of urgency about it at all. It was an hour-a-day, two-days-a-week type of job, if and when, as you please.

Well, I had been through the last war, and I rebelled at the idea of our assuming that we could meet two days a week every other week and do a job. Nobody else outside a few men in the War and Navy Departments, so far as I am aware, had any realization of the need of moving fast and moving thoroughly. But when the issue was raised, of course the obvious answer was to push fast for a report.

But while the report was still only an outline as to its objectives and purposes the Board was informed that its report would not be released; that there would be three copies made—one for the President, one for the War Department, and one for the Navy Department. However, the report is now available for those who may want to read it. The report summarized a lot of experience, and it told a lot of things that should be done that were not done until three years later.

Let us try to be fair at least about this appraisal of the situation in Washington in 1939 and 1940. Mr. Roosevelt was helping the British in every way he

could without getting into the war. There certainly is no need to review the desire of America to keep out of the war at that time. I am sure an honest appraisal today would permit me to say that no man in public life could last if he had been prepared to talk war at that time. I recall the 1916 election had been won on the promise to keep us out of war, and I assume the situation was the same during the 1942 election.

Men everywhere were afraid to talk preparedness for fear of being charged that preparedness was a camouflage for a desire to go to war. And men did not have the integrity of purpose and courage of conviction to face that charge.

Now I know perfectly well that if we had begun in 1939 we could have had a year's start on matériel planning even if Congress had not provided appropriations. We could have had a year's start in the planning of the organizational setup to handle these great civilian agencies that had to come to Washington in wartime. We could have defined their functions so we would not have had this overlapping jurisdictional fight for existence during the war.

ONE day over in the White House Executive Office an adviser said to me, "I do not understand why we have all these jurisdictional fights in Washington." He was worried because he had to settle them. He happened to have on the wall of his room a map of Africa. I said, "Let us just assume something. Let us run a glider over all of Africa now, with thirty men on board. As we go along, hit and miss, we just say to the men in the plane, 'You go overboard and where you land you are king.' That is a nasty parallel to what is happening in Washington, but it is not too far from being accurate."

If we had landed thirty men by plane all over Africa and said, "Boys, you are king where you land," there would have been thirty border wars in five minutes. We had the border wars here.

The wars were not so important, but they annoyed men's souls. The important thing was that they delayed; and out of that grew the other extreme—the idea of a one-man war machine. We wanted somebody to be given a sword and a mace to slam down on the men who would not coöperate. That does not work in a democracy, yet that is always the way those things go: We get annoyed over the delays, then we want somebody with a sword to cut down somebody who will not coöperate.

The only cure I can suggest is to find the kind of man that does not need a sword, the kind of man people like to coöperate with, who is so fair-minded that his conviction carries confidence to his associates.

It is so easy to start off with the theme that an organization is a sort of a pianola—we put a record on and it plays. However it does not work that way. Men have to have convictions in their minds before they can perform on the job.

Something can be done by discipline in the Army and the Navy in war, but I do not believe we can make it work in the undisciplined field of private initiative. I would not say that nothing can be done, but in the end the motive power comes from the free will of free men and does not come from discipline. I am speaking, of course, about the relations of industry to this war machine. In this connection it might be well to review the multitude of kinds of setups we had in the War Production Board and its predecessors alone during this war.

"There cannot be any defense for the kind of mistakes that were made in World War I. If one wants to be softhearted he can say, 'We had no idea of the size of the war. We had had fifty years of peace. Matériel became an important factor in war beyond the capacity of man to understand and plan for.' But the fact is simply that we had gone soft in both services."

We were trying to change organizations and their functions so as to get rid of inefficiency, but it could not be done. If we do not have faith in one man, we appoint two and guarantee inefficiency, indecision, and ignorance. It only teaches us one lesson: our organization planning has to be built around the men we have.

After we got all the agencies set up, we had lots of debates and little action. Then Mr. Byrnes was appointed to settle the arguments. He had to settle those debates in the atmosphere of a judge in a debating society. That is a hell of a way to fight a war! Instead, some one should have the information flowing up to him on which to make a judgment in advance.

A part of the problem has been the growth of the idea of administrative law in this country. I have had to live with it, and it is not too pleasant a tool with which to live. The assumption is that under administrative law the Congress is not wise enough to prohibit wrong acts and therefore appoints some one to decide in his own wisdom what is wrong.

Now let me try to summarize some of the needs that I see today. The first thing that I see that ought to be done is to make an appraisal of the flaws in the assignment of duties and responsibilities to each civilian organization.

There ought to be a current selection of personnel available for and competent to do the key jobs. I rather assume that there are no such files as that in Washington today.

Next there should be an understanding of the functions of all agencies to be established in time of war. And that understanding ought to be in the minds of all people in government and industry and in the services. But the next time let's put it into statute and not make it subject to political pressure.

I suggest to the men in the Army and Navy to build a peacetime organization, particularly on all aspects of procurement, to parallel the civilian war machine which, in turn, ought to parallel as best it can the organization of industry in America.

The men who have known the Army during the last twenty years will recall that those who gained advancement were the men who served with troops. The men who got advancement in the Navy were generally men who served with the fleet. And rightly so. But this job of procurement and logistics in wartime is too important to be handled by men on rotating duty. Until the principle is recognized that logistics work is important, and tremendously so in wartime, we are not going to attract the kind of men we need.

Two New Army Airplanes

The new Republic XP-84 jet-propelled Thunderjet above has a speed of nearly 600 m.p.h., a service range of 1,000 miles, and a service ceiling of over 40,000 feet. The radical Northrop XB-35 flying wing Army bomber below has a range of more than 10,000 miles. Each of its four 3,000-horsepower engines turns a pair of counterrotating 4-bladed propellers (AAF photos).

Personalities and Strategy

A Critique of Ralph Ingersoll's "Top Secret"

Hoffman Nickerson

SOMETHING about the intense frictions within the United Nations and their high command during the recent war was bound to be written. In essence, the theme is as old as history. Certainly no coalition ever ran a hundred per cent smoothly, and no high command ever did unless dominated by one supremely placed and personally strong individual.

Byron writes in "Don Juan" that we are commanded to love our enemies:

> "But nought, to serve our
> private ends,
> Forbids the hating of our
> friends."

Nearly 250 years ago in a memorable passage of English prose, Swift, of "Gulliver's Travels," approached the high-water mark of decorous bitterness with his pamphlet "The Conduct of the Allies . . . in . . . the Present War."

Like Swift, Ralph Ingersoll in his "Top Secret" (New York: Harcourt, Brace & Company, $3.00) is bitter. Unlike the eighteenth-century dean, he writes as if his nerves had been rubbed raw by events. However, he is an able writer and was placed so as to see and hear much. His occasional battlefield experiences read convincingly, and any one who has been on General Staff duty will recognize both the justice and the vividness of his reproduction of the atmosphere in which decisions are made.

His weakness is that he is just a little naïve. Santayana says somewhere that the barbarian differs from the civilized man in that he repeats human experience without knowing that he repeats it. Our author's naïveté comes out in his treatment of the English. Although he tries to end his book on a calmer note concerning them, his closing passages are cold compared to those warmed by his obvious resentment at discovering their national traits—traits which have been an old story to educated and traveled Americans ever since Franklin and the earlier Adamses. In short, like Mark Twain, he is an innocent abroad.

> **"Ingersoll is bitter . . . He writes as if his nerves had been rubbed raw by events. However, he is an able writer and was placed so as to see and hear much . . . His weakness is that he is just a little naïve."**

Thus he is disgusted to learn that England, irrespective of catchwords and political superficialities, is an incurably aristocratic island state in which a special class, the gentry, must lead in war and to which the heavy losses inevitable in great and prolonged ground actions would be ruin.

He is astonished at the flawless unanimity with which the English gentry back their leaders. He sees red as he watches the wealth of maneuvers—some bold, some subtle and devious—with which the English tenaciously tried to get their own way as against their American allies.

Now plenty of Americans have always found it easy to get annoyed with the English—the community of language conceals a mentality so different from our own. I myself in my hot youth——! But that is another story, alien to the present purpose except that if the author of "Top Secret" had studied American experience in 1917-1918 more closely he might have been better prepared for what he recently found. That experience, which he brushes aside as trivial, was illuminating. In any case, an important part of maturity is to realize that creatures of any sort—lions, foxes, or whatnot—simply will do after their kind.

ON the side of military theory, Mr. Ingersoll falls into an error more difficult to pardon than his unpreparedness for English characteristics when he complains that the English tried to make us subordinate strategy to their long-term national policy. Hence, as he truly says, they tried to stress the Mediterranean theater and would have had us move into the Balkans in order to prevent Soviet domination of Eastern Europe. Of course imperial interest was their reason for keeping comparatively large forces in distant theaters which were important to them, exactly as they had done in World War I, and why they correspondingly discouraged a cross-Channel invasion of France.

Unfortunately, before any one can intelligently discuss the higher conduct of war he must have freed his mind from the crude antithesis between "strategy" and "policy." Whether or not one has ever heard of Clausewitz, one must realize that all intelligent strategy must be designed to serve some policy or other. If a nation has no policy in going to war, then its fighting is mere animalism. In other words, to complain of "political interference with strategy" is really to complain that the policy in question is inadequate or shortsighted.

Amusingly enough, our author gives

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away much of his case when he makes two very just side remarks. First, few if any American soldiers—he might have included citizens for that matter—knew of any definite reason why they were fighting. Secondly, many U. S. officers thought of war as a superlative football game. Certain technically very competent Regulars emphatically thought so. In football the object is simply to make touchdowns, then pull down the goal posts and celebrate strenuously, then sober up and try to live happily ever after.

It cannot be too often repeated, however, that the object of war is not merely victory but victory as a means to a better peace than that which preceded the conflict. As Sherman put it: "The legitimate object of war is a more perfect peace."

The British policies of which our author complains may or may not have been wise. Other things being equal, it is always good sense to try for a quick decision, and obviously the quickest way to get at the Germans from the west was across the backs of the French. The British-inspired Italian campaign moved slowly, and a Balkan push might well have proved even slower.

Meanwhile the long-range German rockets might have greatly damaged English cities, while the new, fast German jet planes might have reversed our cross-Channel air superiority. Above all, we Americans wanted to finish the job and go home and were willing to risk much to improve our chances of doing so.

The point about the various "might-have-beens" of the last paragraph is that they are only might-have-beens. The one definite thing is that the cross-Channel invasion succeeded. Practically all France and most of Belgium were liberated in not much more than three months. If the British really doubted whether we would succeed, the event proved them wrong. When we threw the dice, we won.

BUT has the policy of landing in France brought us a good peace? Has it brought us peace at all? The very fact that such questions can be asked gives the answer. The game is not played out, and history may yet conclude that we conquered for the benefit of non-British allies who were never our friends. Perhaps, even as to purely American interests, the British were wiser than we. As yet, who knows?

Aside from this Anglo-American spinal bone of contention, the interest of the book is chiefly its comment on personalities and particular bits of strategy.

Bradley, at whose 12th Army Group headquarters our author saw most of his field service, is the latter's hero. And few if any readers, certainly not this reviewer, will quarrel with the tributes paid to this modest man and excellent soldier. Even assuming that the 12th Army Group several times felt it necessary to "outwit" (p. 289) Supreme Headquarters as to its own plans, the fact would be less conspirational and Machiavellian than Mr. Ingersoll makes it appear. In the nature of things, as armies get larger and at the same time move faster, decisions must be more and more decentralized.

"To read this book is to wonder how Mr. Ingersoll can love his country while hating so many of its traditions, but this book shows that he does. Perhaps, notwithstanding our internal quarrels, we may not end so badly as did the Third French Republic."

On the other hand, that Eisenhower was the mere figurehead which he is here made out to be will require a lot more evidence before it will be widely believed. Granted that the Supreme Commander had been chosen primarily as a conciliator and that he habitually so settled little interallied differences of opinion as to make certain American officers long for an hour of Black Jack Pershing, still this may fairly be taken to imply his belief that only thus could the Grand Alliance be made to work tolerably well.

After all, it is fatally easy to see the shortcomings of generalissimos. One is reminded of Joffre's saying: "I don't know who won the Battle of the Marne, but I know who would have lost it if it had been lost." Mr. Ingersoll also despises Montgomery, the victor of El Alamein. Here again the picture does not seem wholly fair. If the Englishman was sometimes overcautious, sometimes unimaginative like the Grant of '64, sometimes contemptuously rude to Americans, still the little man was a good soldier, and good soldiers seldom "scream" as the author makes him do.

Apropos of the Washington Conference of May 1943, highly indirect but well-deserved praise is given to MacArthur's long-starved but nevertheless successful doings: "Poor old Pacific—the Mediterranean was fixing it for that theater too!"

ONE turns with some relief from "Top Secret's" personalities to its critique of operations. It notes that "most of the killing [*i. e.*, of Germans by Americans in 1944 and 1945] . . . was done by artillery." This again was foreshadowed in not a few of the actions of 1914-1918. On the other hand, the American infantrymen of World War I emphatically thought they knew why they were fighting, and their dash impressed both friends and foes. Somehow, as our author himself admits, the attempt to make World War II into an anti-Fascist crusade did not inspire the same quality.

On another occasion the author is on shaky ground when he makes Bradley solely responsible for the decision to go on attacking through December 1944. For what his opinion may be worth, the reviewer has never doubted that what was done was wise.

In this case Bradley may well have had a large share of responsibility. There is every reason why he should have had. Nevertheless the picture here given is out of focus. In the first place, few decisions today are as personal as the book maintains. In the second place, there is reason to believe that Marshall as much if not more than Bradley was instrumental in this particular matter.

One finally closes the book with the feeling that Mr. Ingersoll has a heart-warming pride in the achievement of American arms. His anger at the British seems by no means all peevishness; he obviously dislikes seeing advantage taken of his countrymen. At the other end of the scale, his voice lifts as he sees the men with U. S. on their uniforms victoriously going forward.

To read this book is to wonder how Mr. Ingersoll can love his country while hating so many of its traditions, but this book shows that he does. Perhaps, notwithstanding our internal quarrels, we may not end so badly as did the Third French Republic.

Maj. Gen. Everett S. Hughes

Chief of Ordnance of the United States Army

ON June 1, 1946, Maj. Gen. Everett S. Hughes, who served in two World Wars and in the Mexican Punitive Expedition, became the seventeenth Chief of Ordnance of the United States Army. He succeeded Lieut. Gen. Levin H. Campbell, Jr., who has retired from active military service.

General Hughes was born in Ipswitch, S. Dak., October 21, 1885. He attended Mankato High School, Mankato, Minn., before his appointment to the United States Military Academy at West Point. He was captain of the first lacrosse team at the academy in 1906 and was a member of the track team. He was graduated from the academy in 1908 as a second lieutenant of field artillery and returned there as an instructor for about three months.

His first assignment after being transferred to the Ordnance Department in 1911 was at Watertown Arsenal, Watertown, Mass., where he was graduated from the Ordnance School of Technology.

The Mexican Punitive Expedition was undertaken shortly after General Hughes returned from a 3-year tour of duty at the Manila Ordnance Depot in the Philippines. He was appointed Ordnance Officer of the Expedition under Gen. John J. Pershing. Later he served as commanding officer, Harlingen Ordnance Depot, Harlingen, Tex. In 1917 he was chief of the artillery section, Procurement Division, Office of the Chief of Ordnance, Washington. He went to France with the A.E.F. in October 1918 and remained overseas until 1919 as a colonel. Between the two World Wars General Hughes had the following assignments:

In 1920 he was a member of the Claims Board, Chicago; Ordnance Officer, Central Department, Chicago; and VI Corps Ordnance Officer, Fort Sheridan, Ill. He was graduated from the School of the Line, Fort Leavenworth, Kans., in 1922; from the Command and General Staff School, Fort Leavenworth, in 1923, and he remained there as instructor until 1927.

Major General Hughes

He was graduated from the Army War College in 1928, and from 1928 until 1932 he was with the Personnel Division, War Department General Staff. From 1932 to 1935 he was chief of the gun testing department at Aberdeen Proving Ground, Md., and from 1935 to 1939 was chief of the manufacturing division, Picatinny Arsenal, Dover, N. J.

He was chief of the Supply Division, Ordnance Field Service, 1939-1940, and chief of the Equipment Division, Ordnance Field Service, 1940-1942.

In July 1942, with the rank of colonel, he went to England as Chief Ordnance Officer of the European Theater of Operations; later he was made chief of staff (Service of Supply) and promoted to the rank of brigadier general. Six weeks later he arrived in London as deputy to the chief administrative officer of the staff which was planning for the North African invasion. From November 1942 to February 1943 he was Deputy Chief of Staff, European Theater of Operations; then he went to North Africa as Deputy Theater Commander (North African Theater of Operations, United States Army). There he became a major general.

General Hughes returned to England in February 1944 as special assistant to General of the Army Dwight D. Eisenhower. He continued on this special assignment until he was appointed Inspector General, United States Forces, European Theater, in September 1945. He returned to the United States in February of this year to assume the duties of Acting Chief of Ordnance.

His decorations include the Distinguished Service Medal, Legion of Merit, Bronze Star, Tunisian Order (Michau Iftikar), Russian Medal, French Legion of Honor, and the Belgian Order of the Crown.

The citation which accompanied the award of the Distinguished Service Medal reads: "For exceptionally meritorious service in a position of great responsibility as Chief of Staff, Services of Supply, European Theater of Operations. His marked organizational ability effecting coördination with the British Staff, seasoned supply knowledge, sound judgment, tenacious fidelity, and courageous advice greatly contributed to the establishment of supply organization and methods successfully used in the occupation of North Africa and reflected great credit upon the Army of the United States."

ARMY ORDNANCE, speaking for the entire membership of the Association, pledges to the new Chief the coöperation and support it has been privileged to give all his predecessors during the past twenty-eight years. General Hughes accedes to his high office at a time when Ordnance responsibilities, particularly in the fields of research and development, are at a crucial stage in our history. He has from firsthand contact an appreciation of the need for preparedness against any future war.

THE next four years will mark the beginning of American ordnance in the atomic age and may well inaugurate entirely new concepts of armament engineering and administration. In these fields, as in all others, America must be kept strong, for upon them in great measure depends the security of our country and the peace of the world.

Choose Your Weapons, America!

Atomic Warfare Demands Balanced Forces

by

Melvin M. Johnson, Jr.

"Today's war cannot be fought with tomorrow's weapons, nor tomorrow's war with the day-after-tomorrow's weapons. You cannot fight today's war with muzzle-loaders, but neither can you fight it with experimental blueprints. In the science of war, as with other sciences, conservatism congealed is catalepsy; radicalism rampant is ruin."

THE various branches of our armed forces are currently engaged in a frantic, desperate, bitter, postwar battle with no holds barred.

Primarily involved in this interservice headline-hurling holocaust are the Army, the Navy, the Air Forces, and the atomic scientists. The scientific group includes those who hold, in substance, that atomic bombs eliminate any real need for the armed forces. The Air Forces, quite determined to gain at least an equal status with the Army and Navy, insist that the next war will be exclusively an atom-bombing air-force operation.

Joining with the Army they aver that the Navy is obsolete. Opposing the Army they contend that land armies are passé. Somewhat at sea in the face of all these combined attacks, the Navy, forced into an unaccustomed though dignified defensive, patiently expounds the past virtue and points to the future necessity of the pure Navy-operated fleet.

Many of the arguments, but most especially the manner of their presentation, have done no great credit to some of their sponsors. Worst of all, regardless of the merits, the brass- and braid-bound belligerents have somewhat weakened public esteem for the armed services as a whole.

Because this is still a very wicked world, our people must not become confused about this problem. We may yet again be forced to choose our weapons. At such times all the basic weapons must be ready and available for our choice.

IN a relatively pure democracy such as ours the American people must determine at least what our fundamental defense policy shall be. Accordingly, let us analyze objectively what might be needed by the United States in the unfortunate event of another war, quite apart from the acrimonious arguments and volatile vociferations of the Army, Navy, Air Forces, and atom scientists.

All can agree that weapons as such are absolutely essential to fight a war, whether on the offense or on the defense. The prime function of any weapon of war is to incapacitate or kill enemy personnel; to render untenable enemy positions, facilities, and installations; and to render inoperative or to destroy enemy equipment, weapons, and vehicles.

The prime function of protective measures or agents is to neutralize or reduce the effect of a given weapon. Thus, a high-explosive shell is a weapon, and a steel helmet is a protective agent which reduces the effect of shell splinters on the head.

A counterweapon signifies one which is active rather than passive. Originally the tank was a counterweapon to the machine gun, just as later the tank destroyer was a counterweapon to the tank. Antiaircraft guns are counterweapons.

Tanks, battleships, and airplanes are often described as weapons, and in the broader aspect we contemplate them as such. Actually they are not—they are vehicles. Tanks, battleships, and airplanes do not become weapons in any sense of the word unless and until we mount in them guns with ammunition or bomb racks with bombs. The most fundamental illustration of this fact is found in the infantry soldier. Only when armed with his rifle or machine gun and ammunition does he become a weapon. Similarly a tank is not a weapon until it is equipped with armament.

Atomic explosive is a weapon and as such may readily be applied to the widest variety of military purposes. Apart from the obvious development of robot bombs and antiaircraft rockets, balloons carrying atomic explosive might conceivably be released into the stratosphere and set off upon the radar-signaled approach of enemy aircraft.

The combination of the less-heralded though amazing proximity fuze with atomic explosive, projected by an antiaircraft robomb or robot plane, would offer another powerful counteraircraft weapon. All possibilities for the military applications of atomic explosive must be considered, not just the more obvious and briefly demonstrated employment of this devastating development as a one-way bomb to destroy cities or to annihilate nations.

However, the only positive and ultimate method of avoiding the final destruction of our country by enemy "robatoms" is to capture his launching sites and destroy his facilities. That necessarily involves the landing of trained armed men and equipment to overwhelm the enemy on the ground.

Melvin Johnson is the author of "Rifles and Machine Guns of the World's Armies"; co-author, "Automatic Arms," "Ammunition," and "Weapons for the Future." He is the inventor of the Johnson light machine gun and the Johnson automatic rifle. He is a captain in the U.S. Marine Corps Reserve on inactive status.

A large staff of skilled experts will be required to operate a "robatom" launching site or its equivalent. Unless such facilities and personnel are well armed against local attack, a relative handful of professional infantrymen with machine guns, grenades, bazookas, and flame throwers, would quickly massacre them and their "push buttons." Such ground forces can land suddenly from the air or from the sea. They could only be stopped by opposing ground forces.

From the technical military point of view it is undeniably ridiculous to propose that today's war should be fought with yesterday's weapons and techniques. The French Army in 1939 was very well prepared to fight the German Army of 1914. But there is another and equally imperative proposition. Today's war cannot be fought with tomorrow's weapons, nor tomorrow's war with the day-after-tomorrow's weapons. You cannot fight today's war with muzzle-loaders, but neither can you fight it with experimental blueprints. In the science of war, as with other sciences, conservatism congealed is catalepsy but radicalism rampant is ruin.

New developments take abundant time and patience. The ultimate product can rarely be produced on a timetable basis. However, the enemy is usually working just as hard to complete his development first. The atom bomb was initially employed in August 1945. It was obviously not ready until then. Fortunately for us the Germans were still in the development process in the fall of 1944 and early 1945.

Arguments may rage for centuries hence as to the real influence of the atom bomb on Japan's surrender. The fact remains that the first bomb was dropped on Japan by a U. S. Army airplane which took off from an island base maintained, supplied, and protected by the U. S. Navy, and previously captured from the tenacious Japanese by the U. S. Marine Corps, supported by naval, air, and sea forces.

Pending incontrovertible proof of the U. S. Navy's obsolescence we must continue to bear one obvious fact in mind. We could never have defeated Japan or landed in Europe without the Navy!

The solemn statement is frequently made of late that *there is no defense against the atomic bomb!* This pernicious platitude implies that one nation must submit to the unmitigated and deliberate bombing of the homeland by another without recourse.

An infantryman can assure you that there is no defense against well-aimed machine-gun bullets. Of course you can lie in a ditch. If you are in a very deep pillbox the artillery cannot hit you, but a flame thrower can burn you out. However, one well-placed rifle bullet will finish the flame thrower.

These illustrations can be extended to include every weapon. Obviously there are certain defensive measures which may be employed to reduce the effectiveness of any weapon. Infantrymen crawl—they do not stand patiently to be shot by enemy machine-gun fire. They dig foxholes and wear steel helmets. That reduces casualties. Artillerymen try to hide their gun positions. Battleships use heavy armor, watertight compartments, and torpedo nets if practicable. Civilians take refuge in protective cellars during bombing raids. No, there is no absolute pure defense against any real weapon!

However, there are always counterweapons. There have always been counterweapons. There always will be. Hence there will be counteratom weapons. One of these will be atomic explosive itself! Weapons always work both ways, provided you have them, enough of them, and adequate expert personnel to operate them.

AS a weapon, the atom bomb is either projected from an air vehicle, as on August 7, 1945, or by a rocket or robot bomb launched from a base on land or from a vehicle on the sea. If it is carried by an airplane, then there are already counteraircraft weapons, and there will be even more deadly and effective ones. Antiaircraft rockets are already reaching many miles into the air. The proximity fuze gives antiaircraft artillery a new significance, apart from the possible combination of this fuze with atomic explosive.

The further development of atomic weapons indicates that the smaller nations will either remain on the sidelines or be virtually obliterated. Atomic bombardment delivered by a large continental power against any one of the numerous small nations, especially small island nations, would have but one ending. Probably it would not even have to start. But most small nations have little chance against big powerful ones anyway. Contemplate the German invasion of Holland, May 10-15, 1940.

Next consider the atomic attack of a large powerful nation against a reasonably large but weak one, such as Germany against France in May-June 1940.

"Any vociferous protagonist of any single 'weapon' or any single branch of any so-called armed service claiming to possess the sole solution of warfare and urging various schemes of overall command which make possible the ultimate emasculation of our ground, sea, air, or scientific forces, is selling our country a dangerous, unsound, and suicidal bill of goods."

Assume the Germans had superatom bombs available. Probably after the annihilation of one city France would have surrendered at once to save her resources.

On the other hand, Germany wanted the use of French resources, facilities, industries, and ports. The German objectives would have been defeated by the atomic annihilation of France. On the whole, most aggressors have similar objectives. Hence indiscriminate atomic bombardment would defeat the aggressor's purpose.

In our own broad-scale counteroffensive against Japan, however, our objective was purely and simply complete unconditional surrender of the enemy. As of August 7, 1945, Japan was still left with a powerful defensive land army and nothing else—no air force and no navy. Japan not only had no atomic bombs but absolutely no means of launching such bombs against our homeland.

By March 1945 Germany was in a far worse position. Thus we did not risk any possible counteratomic attacks on ourselves when we struck Hiroshima and Nagasaki in 1945, and the preservation of Japanese resources and facilities was entirely unimportant.

Any nation or group of nations seeking control of the world or even of any major part of either hemisphere must first completely eliminate the United States. Germany has twice learned this lesson.

We have an amazing globe-sectioned mixture of races and nationalities in

this country. We read more, hear more, and fall for more artful asininity and erudite excrement per capita than all the rest of the world combined. We are therefore certain to be invaded first of all, not by the boundless blasts of atomic bombs and rockets, but by the subtle-strangling, power-paralyzing tentacles of a pseudopious propaganda.

After we have been enfeebled by this prolonged but patient process and reduced to a thoroughly confused state of self-suspicion and international uncertainty, the initial military attack will be launched. The weapons may be chiefly atomic artillery, aimed primarily at our industrial centers and calculated to complete our final moral disintegration in the hope we will overthrow what remains of our government and sue for immediate peace. If we do, substantial occupation by enemy land armies will be a major condition. Our entire population, economy, and resources will be under complete enemy control, aided by a no doubt shocking but hardly inconceivable abundance of our supposedly loyal citizens.

With America under his control, the enemy would have the rest of the world in the palm of his hand. Therefore the complete annihilation of America by atomic explosions will not be sought, but rather our political, physical, moral, industrial, and economic enslavement.

Atomic explosive is in consequence a military weapon employed solely to produce a long-sought politico-economic result. In this case the strategic objective would be the specific political elimination of the United States of America, but not by any means the annihilation of the productive North American continent as such.

ON the obvious assumption that we want none of this to befall our country, what might be done to prevent such a defeat and to eliminate the aggressor who attempts it? What types of weapons must be used?

First of all, when the propaganda attack starts (or perhaps more accurately, now that the propaganda attack has started), we must remember that words are weapons. We must counterattack vigorously, and carefully evaluate subversive statements, falsehoods, and innuendoes. Moreover, we must maintain an intelligence service of superlative efficiency.

Next we must continuously develop effective new weapons and counter-weapons. Already tests are being made by the guided missiles section of the Army Air Forces with counterrockets having atomic war heads which can be electronically directed to explode and destroy enemy "robatoms" and atom-bomb aircraft, according to recent press dispatches. Our radar detectors were closed down for the day on Sunday December 7, 1941. Radar detectors or their highly modernized equivalent can and must be kept alerted continuously.

Next we must emphatically retain and maintain outlying naval bases around the world from which we can at once launch powerful counterattacks against any enemy bombardment. In one aspect these naval-air bases serve as fire alarms. The enemy cannot afford to ignore them and must thoroughly reduce such points of resistance before proceeding to our homeland. Hence these outposts must be kept strong.

Operating from well-established and sea-supplied bases our air forces can proceed at once to counterattack enemy "robatom" launching sites and intercept enemy bombing planes. Enemy sea-borne landing forces can also be intercepted by modernized fighting ships as well as naval aircraft.

We cannot afford and dare not endure war's holocaust upon our homeland. Therefore the battle must be carried to enemy shores. This means that from our advanced naval bases and from the outer fringes of our continent we must launch counteratomic artillery fires which can be followed up by intensive landings in force on the enemy homeland. The cost of landings on hostile shores is always greater than we like to contemplate. The cost of enemy landings on our own shores, however, is beyond contemplation, for such landings spell all the letters of defeat.

The developments of science have brought the four corners of the world closer together. The implications of such technological trends are unmistakable in the art of warfare. The range, accuracy, volume of fire, and mobility of weapons is inexorably increased. The objectives are the same, but the means of attaining them are enormously expanded, and the time factors have been greatly reduced.

The broad problems and the general solutions are fundamentally equivalent to those of earlier centuries. Destruction, after all, is not the primary objective of war but merely an incidental means. The ultimate and final objective is control. Only when one power controls the economy, territory, and physical population of another does that attacking power stand finally triumphant and in full possession of the fruits of victory.

IN any future war the air forces must be based on the ground. Ships must operate from shores whether island or mainland. Armies must operate from and on the ground. The advances of aviation do not alter these facts. The developments of atomic explosive and rockets do not change these conditions. Therefore, any future war will be fought on the same foundations as before. Atomic explosive in its multifold applications will increase the armament potential and effectiveness of the ground forces, naval forces, and air forces, but we shall still have the land, the sea, and the air. Moreover the laws of gravity still apply, in fact more so than before.

To fight any future war, in addition to tireless teams of scientists and Ordnance technicians we shall need an army, a navy, and an air force. These fighting forces will employ the more diversified and versatile weapons which modern scientific research and development have made and are making available.

Any vociferous protagonist of any single "weapon" or of any single branch of any so-called armed service claiming to possess the sole solution of warfare and urging various schemes of over-all command which make possible the ultimate emasculation of our ground, sea, air, or scientific forces, is selling our country a dangerous, unsound, and suicidal bill of goods.

Any proposal to the people of America which tends to weaken or reduce any one of our three integrated basic weapons, the ground-force arm, naval arm, or air arm, or which minimizes or obstructs continuous and concentrated scientific research and development, is hostile and destructive to our national security in this era of the greatest potential international crisis in our entire history.

Think clearly and carefully, then, America, and choose your weapons intelligently for the security of our homeland and for the strict and just enforcement of world peace, law, and order.

Is the Sky the Limit?

Ordnance Rockets Demolish the Barriers of Space

Dr. Frank J. Malina

Acting Director, Jet Propulsion Laboratory, California Institute of Technology

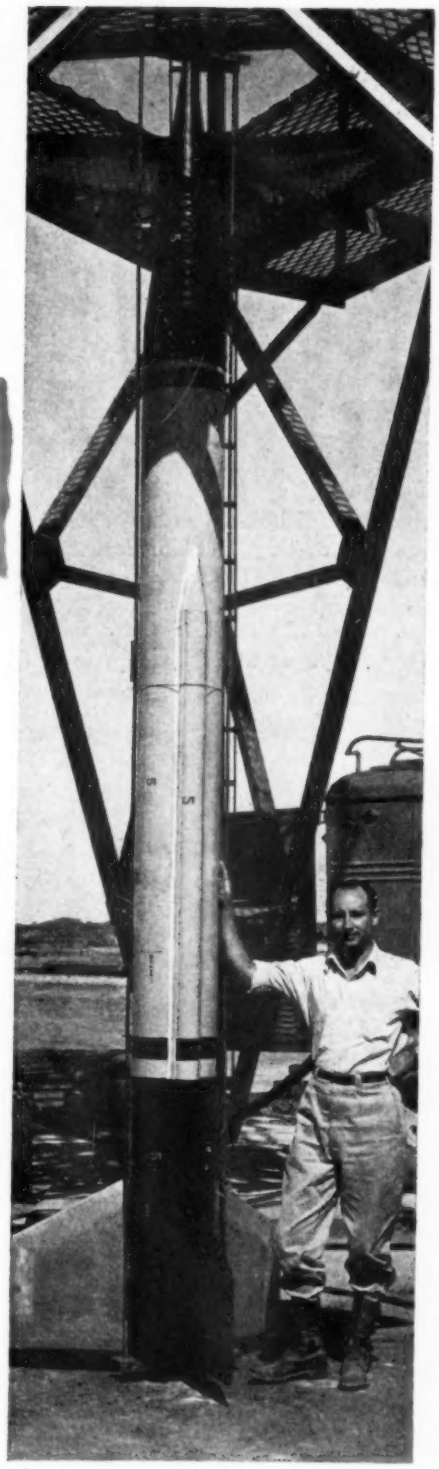
THE minds of men have long questioned the physical nature and the behavior of the boundary layer between the earth and the space through which the earth travels on its orbit. The early Greeks made the first attempts to describe the atmosphere and to understand the causes of "weather" on the basis of elementary physical measurements. However the inadequate knowledge they possessed forced them to depend primarily on purely philosophical conceptions.

In this way Aristotle arrived at the conclusion that the atmosphere was divided into three layers. He considered the layer nearest the earth in which life exists as fixed to the earth; the top layer he believed to be attached to the fiery heavens and to move with them; the region between these two layers he hypothesized to be extremely cold.

Since the Aristotelian view of nature persisted for centuries essentially unchanged, no new interpretations of the atmosphere appeared until the Renaissance, although the Arabs in the eleventh century are credited with estimating from the duration of twilight that the atmosphere extended to a height of fifty-seven miles.

A REALISTIC notion of the nature of the earth's envelope began when Torricelli, a student of Galileo, in 1643 constructed the barometer for measuring the pressure of the atmosphere. With this and other instruments the study of the structure of the atmosphere was undertaken up to the heights of mountains. Toward the end of the eighteenth century the balloon was invented and quickly applied to extend the upper range of investigation. The sounding balloon has since been developed to a high degree of usefulness; however, the maximum altitude that can be reached under most favorable conditions is about twenty miles.

Although men were curious for some time past to investigate the atmosphere above the limit of balloons, only during the last few years has an urgent need arisen for information at higher levels. It is well known that curiosity alone is seldom considered sufficient justification for the outlay of funds of the magnitude required. The need for this information has been brought about by modern developments in meteorology, radio communication, aviation, long-range guided missiles, and nuclear physics.



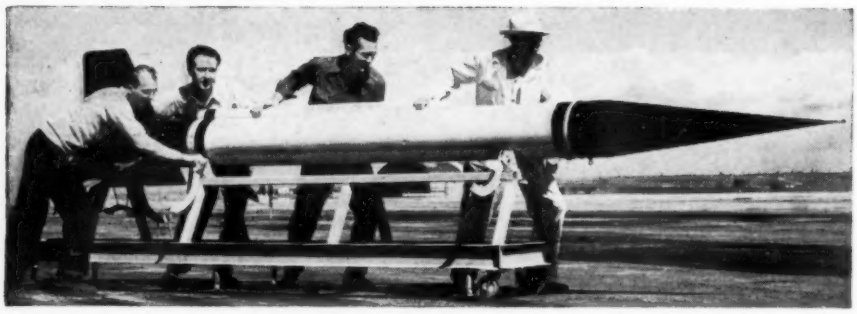
The WAC Corporal ready for loading into the launching tower.

THE possibility of employing rocket propulsion for lifting a vehicle to great heights was realized at the beginning of this century. Serious consideration of the use of rockets for upper atmosphere research was initiated in this country by R. H. Goddard in about 1914.

At first he studied the feasibility of utilizing the solid-propellant type rocket, but later concluded that a liquid-propellant type would be superior for reaching very high altitudes. He spent many years working on the various problems connected with a sounding rocket, and a great portion of his later efforts was devoted to the development of flight-control equipment.

In the early 1930's the subject of rocket propulsion became of interest to various enthusiasts in the United States, with members of the American Rocket Society the most active in pursuing investigations with the funds available.

In 1936 a group of research students at the California Institute of Technology became interested in the problem of the sounding rocket, and theoretical and tentative preliminary experiments were carried out until 1939 when work was undertaken for the Army Air Forces on rocket-propulsion systems suitable for the auxiliary propulsion of aircraft. The ideas for a sounding rocket were not implemented until December 1944 when the Ordnance Department requested the Jet Propulsion Laboratory to design and construct a prototype model for the use of the Signal Corps. This model was required to carry 25 pounds of instruments to an altitude of at least 100,000 feet.



Wheeling the WAC to the flight ramp.

A conservative estimate of the factors entering into the design of such a vehicle was made, and it was concluded that the requirements could be met. As development of the vehicle proceeded, material reductions in estimated empty weight were achieved, so that by the time firing tests were initiated at White Sands Proving Ground, N. Mex., in September 1945, the vehicle, known as the "WAC Corporal," reached an altitude of approximately 230,000 feet.

IN order to carry out investigations of the upper atmosphere, it is necessary first to have a vehicle that is capable of reaching the maximum specified altitude; secondly, to develop instruments suitable for making and recording measurements of upper atmosphere phenomena; and, finally, to evolve techniques for recovering the records obtained. Each of these phases poses difficult technical problems, especially the second and third one upon which serious effort is now being concentrated, and about which little can be said in a definite way. Therefore we will limit ourselves in the present discussion primarily to the vehicle phase.

The balloon is able to lift itself and a useful pay load because the weight of air displaced by the hydrogen-filled bag is greater than the weight of the vehicle. When the best sounding balloon so far developed reaches an altitude somewhat over 100,000 feet it comes to rest because the displaced rarefied air then equals the weight of the vehicle. Heavier-than-air craft depend on motion through the air for their sustention and at the present time the altitude limit of such craft appears to be in the neighborhood of 60,000 feet.

In order to lift a body to altitudes above the balloon limit, it is necessary to apply a propulsive force to the body which will either accelerate it rapidly to very high velocity so that the body will coast to high altitudes, or to accelerate it gradually for a relatively long period of time. Shells from guns have reached heights well over 100,000 feet; however, the acceleration imparted to the shell in the gun barrel is so great that it is practically impossible to design instruments to withstand the firing shock.

Jet propulsion furnishes the most promising method for imparting the required velocity to the body with manageable accelerations. Of the various jet-propulsion schemes that have been developed to a high degree of reliability within the last few years, the rocket-propulsion system is the most satisfactory for the attainment of extreme altitudes.

In a rocket the propulsive force is obtained from the reaction produced by the high-velocity jet composed of a propellant mass carried wholly within the rocket. The force is not affected by the velocity of flight of the rocket, and, since the oxygen in the atmosphere is not utilized for combustion, the rocket will operate even in empty space. As a matter of fact, the rocket is most efficient in absolute vacuum.

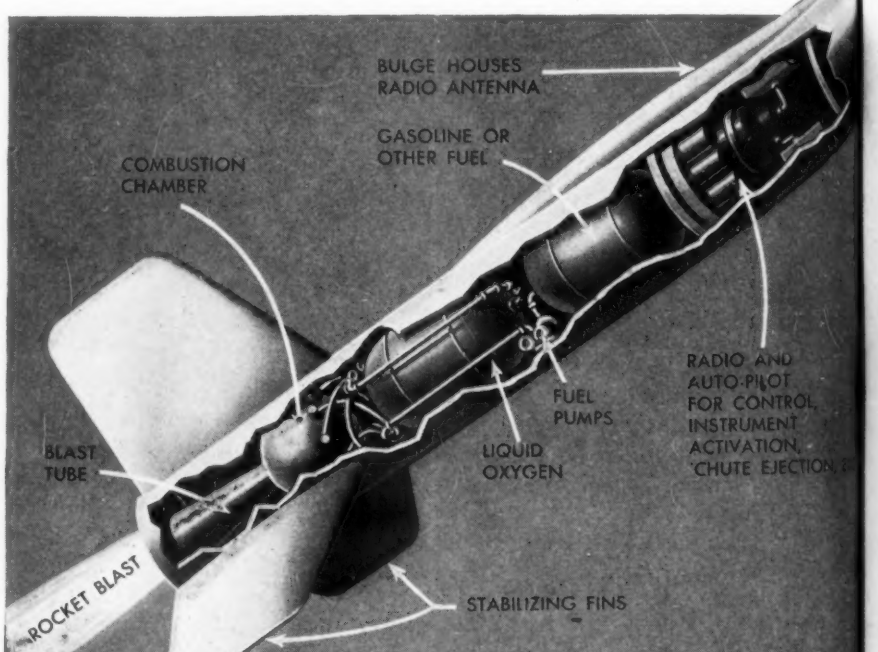
We might be led to believe from our experience with the familiar skyrocket that the design of a high-performance sounding rocket is not a complex engineering project and that its operation in the field is as simple as lighting a powder fuse. That this belief is erroneous will become clear from the following considerations.

Before the button is pushed which starts the rocket on its way to the desired height above the earth's surface, we must resolve these problems:

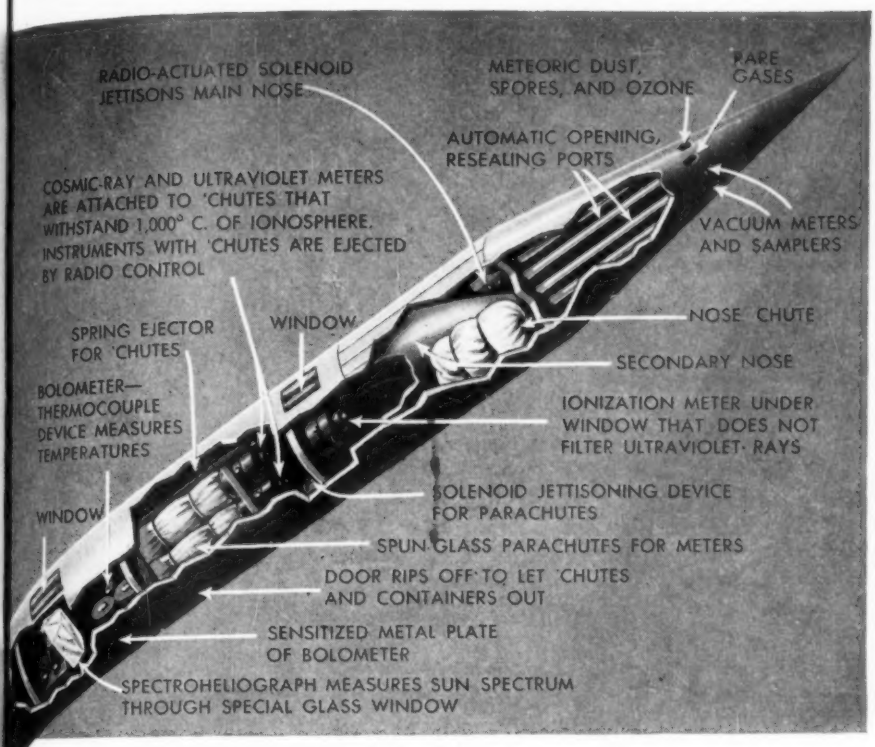
(1) Choice of propellant and type of propulsion system; (2) Size of rocket to carry the desired pay load; (3) Shape of rocket to give minimum air resistance and adequate flight control; (4) Launching method.

As one might expect, the separate optimum solutions of these problems will almost certainly clash when an attempt is made to incorporate them into a unified vehicle. To minimize the contradictions that can arise, we need to know something about the relationships between the various problems.

These relationships have been well



This artist's conception of the WAC Corporal is not necessarily authentic but it indicates graphically the design and possible uses of a sounding rocket. Devices can be incorporated to take samples of the upper atmosphere, to record the strength of cosmic rays, and to broadcast a continuous account of temperature and weather conditions. Equipment and vital parts are recovered by parachute.


RADIO-ACTUATED SOLENOID JETTISONS MAIN NOSE
METEORIC DUST, SPORES, AND OZONE
RARE GASES
AUTOMATIC OPENING, RESEALING PORTS
COSMIC-RAY AND ULTRAVIOLET METERS ARE ATTACHED TO 'CHUTES THAT WITHSTAND 1,000° C. OF IONOSPHERE. INSTRUMENTS WITH 'CHUTES ARE EJECTED BY RADIO CONTROL
VACUUM METERS AND SAMPLERS
NOSE CHUTE
SECONDARY NOSE
SPRING EJECTOR FOR 'CHUTES
WINDOW
BOLOMETER—THERMOCOUPLE DEVICE MEASURES TEMPERATURES
IONIZATION METER UNDER WINDOW THAT DOES NOT FILTER ULTRAVIOLET RAYS
WINDOW
SOLENOID JETTISONING DEVICE FOR PARACHUTES
SPUN GLASS PARACHUTES FOR METERS
DOOR RIPS OFF TO LET 'CHUTES AND CONTAINERS OUT
SENSITIZED METAL PLATE OF BOLOMETER
SPECTROHELIOGRAPH MEASURES SUN SPECTRUM THROUGH SPECIAL GLASS WINDOW

Courtesy Popular Science

defined as the result of studies made by various investigators on the performance of a vehicle in vertical flight. They will hold as long as the propulsive force is constant during powered flight, and it does not matter if the propulsive force is obtained from the energy of the propellant by a molecular or by a nuclear process.

The performance of a sounding rocket is found to be determined primarily by six parameters. The first two, which are descriptive of the propulsive system, are the specific impulse of the propellant utilized and the time the thrust force acts on the vehicle. The "specific impulse" is a descriptive term used to designate the number of pounds' thrust that can be obtained from each pound of propellant each second. The next two parameters, which deal with the weight characteristics of the vehicle, are the ratios of the propellant weight to the initial gross weight and of the initial gross weight to the cross-sectional area of the rocket. The last two parameters are the velocity at which the rocket is launched from the earth and the altitude of the launching point.

In addition to these basic parameters the performance of the vehicle will be influenced by the shape of its nose and stabilizing surfaces and the ratio of its length to its diameter. Aërodynamic shapes must be chosen that will produce the minimum of air resistance over the wide speed range traversed during accelerated flight through the atmosphere.

Extensive design charts have been prepared to guide the engineering development of a sounding rocket to meet given requirements. We will not be able to consider in this article the detailed implications of the basic parameters; however, a few general conclusions can be pointed out.

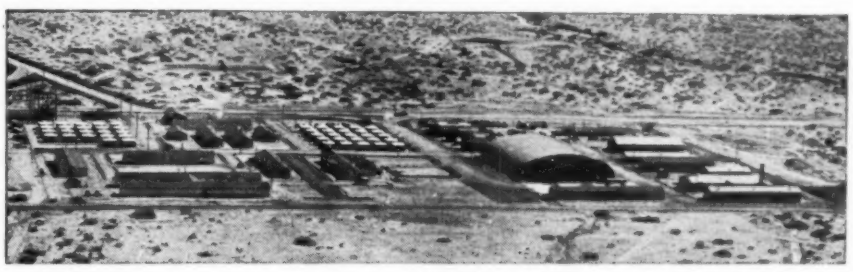
At the present time the energy of the rocket propellant must be released by combustion (molecular process). The highest specific impulse that can now practically be obtained at sea level from a usable solid propellant is about 200 pounds sec./lb. and from a liquid propellant about 240 pounds sec./lb.

THE ratio of propellant weight to initial gross weight of the rocket is of extreme importance. A high-performance sounding rocket must have from fifty to eighty per cent of its weight in the form of propellant. This requirement stresses the critical importance of achieving the minimum in weight for the vehicle structure and propulsive system. For example, if the empty weight of the WAC Corporal is reduced by 50 pounds, corresponding to a saving of 18 per cent in structural weight, an increase in altitude of about 60,000 feet can be expected.

In order to minimize air resistance, it is advantageous to have as high a value as possible for the ratio of the initial gross weight to the cross-sectional area of the rocket.

Since only twenty to fifty per cent of the initial gross weight of the rocket is available for structure, propulsive system, and pay load, we can conclude that the required size of the rocket will be primarily determined by the pay load that is to be carried to a given altitude.

Let us assume that a rocket weighing initially 1,000 pounds can be designed to carry a pay load of 100 pounds to 500,000 feet; then if we want to increase the pay load to 500 pounds, we can expect the rocket's initial weight to be about 5,000 pounds. Actually, the per-



Aërial view of quarters and shop area of White Sands Proving Ground, N. Mex.

missible pay load ratio improves considerably as the size of the rocket increases because, first, the structural efficiency improves and, secondly, the fraction of the thrust lost in overcoming drag decreases.

The advantage of a high launching velocity, when obtained by means auxiliary to the vehicle-propulsion system, is evident as is the advantage of launching the vehicle from a high altitude to minimize air resistance.

Let us now take a quick glance at some rocket vehicles that have been actually launched. The first serious sustained effort to construct a sounding rocket was carried out by Dr. Goddard. Although the highest altitude reached by one of his rockets was about 7,500 feet when it was launched on May 31, 1935, the rocket is of considerable historical interest. Unfortunately, very meager information was published on the rocket by Goddard before his death in 1945.

THE Goddard rocket was somewhat over ten feet and the diameter about eight inches. A liquid propellant combination consisting of liquid oxygen and gasoline was used with a motor that delivered about 300 pounds' thrust for a period of approximately 20 seconds. The rocket was launched from a 60-foot tower with an initial velocity of zero. To maintain a vertical flight path, control equipment was provided to operate movable surfaces in the rocket jet. Photographs of the flight show the rocket traveling with an oscillatory yawing motion in the manner of a fish swimming in a vertical direction.

High altitudes were first reached by the German V-2 rocket. This vehicle was designed primarily for carrying an explosive charge for the destruction of ground targets. Many of the rockets were launched against England during World War II at a range of about 200 miles, and during the trajectory of the rocket a maximum altitude of approximately 300,000 feet was reached.

At the peak of the trajectory the flight speed was about 3,500 feet a second. The German technicians who designed the V-2 state that two of the missiles were maintained in vertical flight after launching and reached an altitude of 560,000 feet.

The length of the V-2 rocket is 45 feet, 10 inches; its diameter is 5 feet, 7 inches; and at launching it weighs 28,200 pounds. The initial gross weight

Attaching the WAC's needle-sharp nose for piercing shock waves at supersonic speeds.

is made up of a propellant load of 19,000 pounds, a pay load of 2,200 pounds, and an empty weight (structure, propulsion system, and control equipment) of 6,900 pounds.

The rocket uses a liquid oxygen-alcohol propellant combination from which an average specific impulse of about 223 pounds sec./lb. is obtained during powered flight. The propulsion system delivers a sea-level thrust of about 55,000 pounds for 65 seconds. A predetermined trajectory is maintained by means of an autopilot system which operates vanes both in the air stream and in the rocket jet. The missile is launched from a vertical position with zero initial velocity.

We have sufficient information on the V-2 to evaluate the primary design parameters we considered earlier. We obtain the following values:

Average propellant specific impulse	**223 lbs. sec./lb.**
Thrust (sea level)	**55,000 lbs.**
Thrust duration	**65 sec.**
Ratio of propellant weight to initial gross weight	**0.675**
Ratio of initial gross weight to cross-sectional area	**1,155**
Launching velocity	**0 ft./sec.**
Launching altitude	**Sea level**

In the case of the V-2, the pay load amounts to 7.8 per cent of the initial gross weight. From the point of view of utilizing this rocket for investigations of the upper atmosphere, the amount of pay load that can be carried is more than adequate. The chief limitation of this vehicle is an economic one, for to fire a single round about $75,000 must be expended, and this depends on whether or not the OPA can "hold the line."

Also, in spite of the fact that the V-2 had reached a high stage of development, the Germans found that about thirty per cent of the missiles launched failed to perform satisfactorily. We can well imagine the discomfort of the Government budgeteers if they were asked to approve the expressed desire of one scientist to launch 200 sounding rockets simultaneously at various points of the globe, not as a single experiment but to be repeated several times.

Fortunately, most measurements of upper-atmosphere phenomena do not require instruments of very great weight, and, furthermore, many scientists feel that during the next decade most studies will be concentrated within the layer up to about 300,000 feet. To meet these requirements, a vehicle of much smaller initial gross weight, and therefore cost, can be employed.

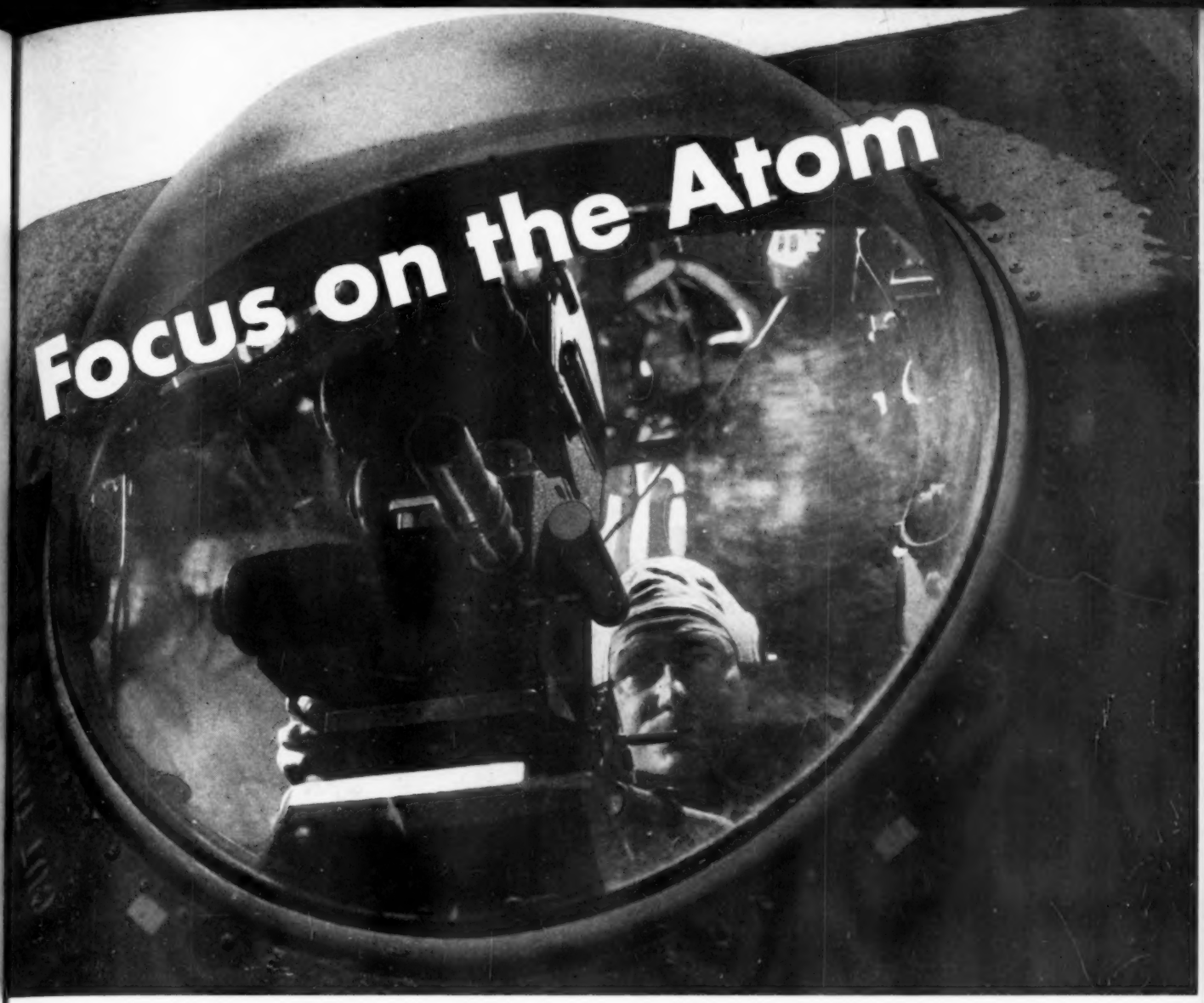
The first version of the WAC Corporal reached an altitude of about 230,000 feet. It has an over-all length of 16 feet, a diameter of 1 foot, and an initial gross weight of 696 pounds. A breakdown of this weight is as follows: propellant, 374 pounds; pay load, 25 pounds; structure, propulsive system, and compressed air, 297 pounds.

No flight-control equipment is used; instead, the vehicle is launched from a 100-foot tower by means of a booster rocket which gives the vehicle a high initial velocity by the time the booster thrust is ended at a height of about 150 feet above the launcher. In this manner the effect of wind is minimized, and the fixed fins of the WAC are able to maintain essentially vertical flight. In the experiments made in New Mexico, one WAC round landed a maximum distance of about seven miles from the launcher when no parachute was used during descent.

THE WAC is an interesting example of the use of the step-rocket principle which, when utilized to the maximum of its effectiveness, is capable of transporting the final step of a combination to very great heights.

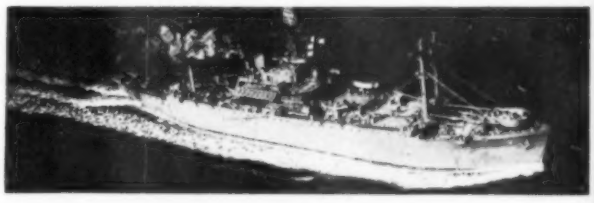
For example, if the WAC Corporal were launched as the second step with a V-2 as the mother vehicle, then calculations show that an altitude of approximately 2,000,000 feet would be reached by the WAC Corporal, and at the end of its powered flight it would have a velocity of 9,500 feet a second.

Focus on the Atom



When the atomic bomb rocks Bikini Atoll in the Marshall Islands this summer, the world will be watching through the eyes of observers from many countries and through the cameras operated by men of Joint Army-Navy Task Force One. Operation Crossroads may reveal many secrets (Navy photos).

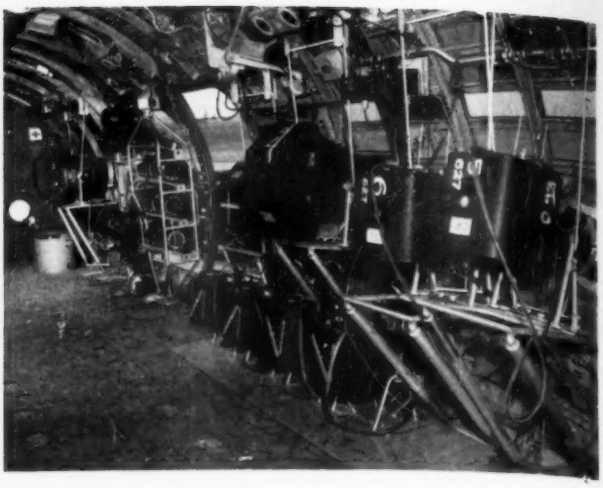
The 28 cameras of the F-13, left, formerly a B-29, will be among many others to film the A-bomb.



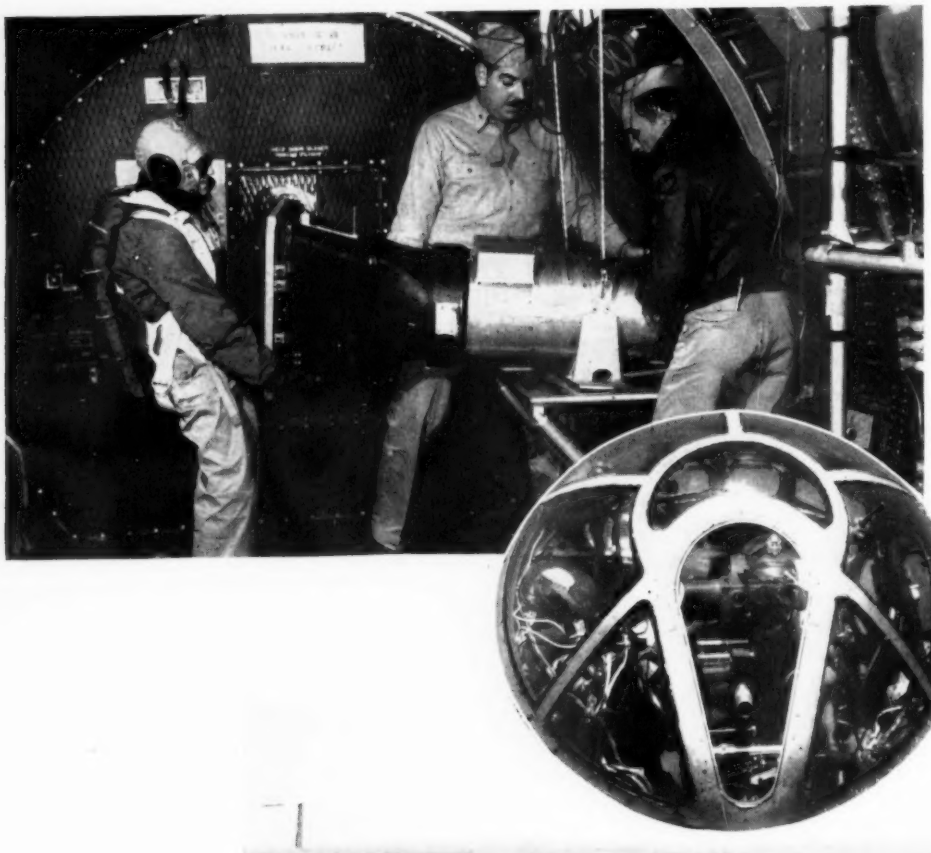
The U.S.S. Blue Ridge, above, will be the floating headquarters for the A-bomb observers.

The F-13 above and the Navy F6F remote-controlled drones, right, will also film the tests.

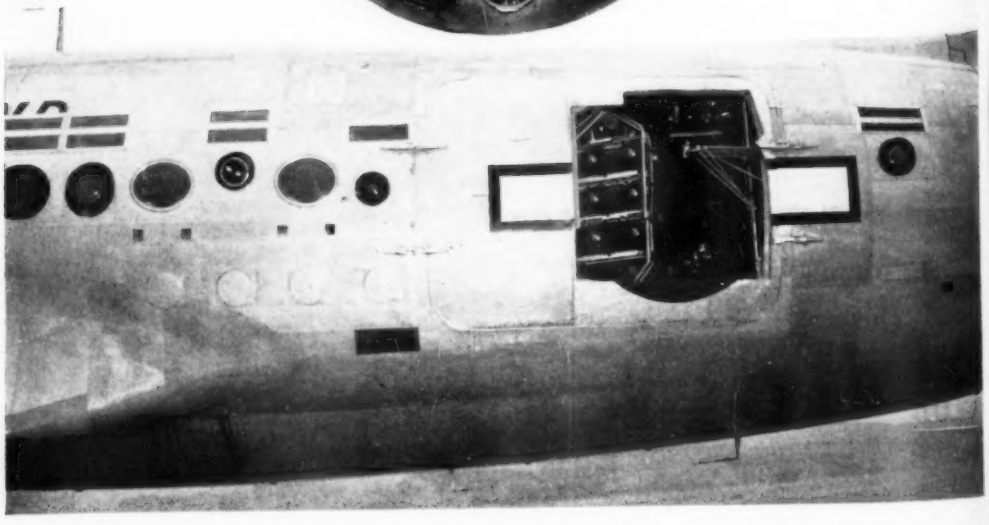
Man your cameras! Photographers in a converted C-54 camera plane operate some of the 21 cameras of 7 different types which will help record the A-bombardment.



A close-up of the various types of cameras shown in operation at the left. Two tons of photographic film will be used to cover the Crossroads tests ashore, afloat, aloft.

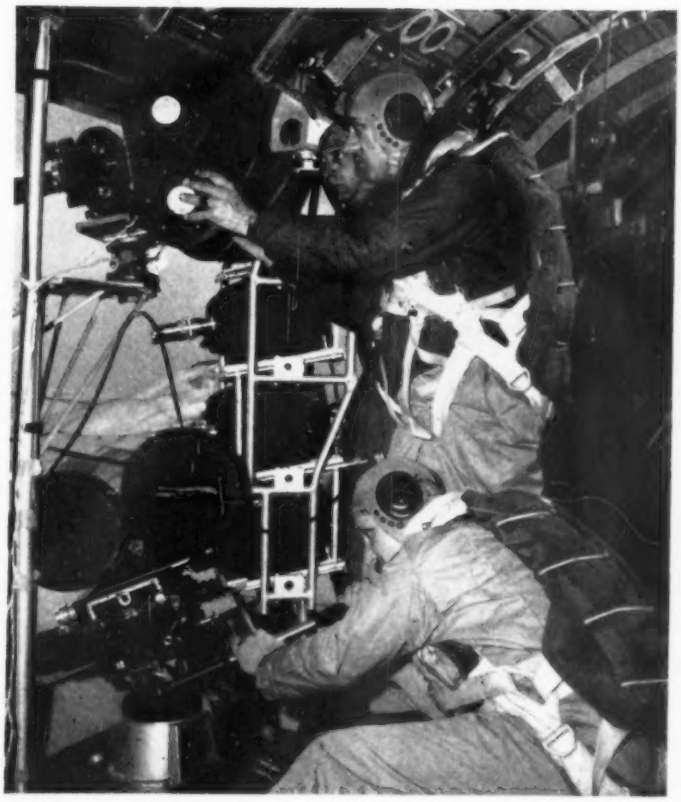


It takes 3 men to install this 48-inch 200-pound aërial camera in a C-54 photo airplane. It's suitably called "Big Bertha."



Side view of the C-54 camera plane shows some of the cameras lined up in readiness to "shoot" the atomic bombardment.

Part of the Operation Crossroads fleet of target and support ships is shown above readying at Pearl Harbor before sailing for Bikini in the Marshalls.

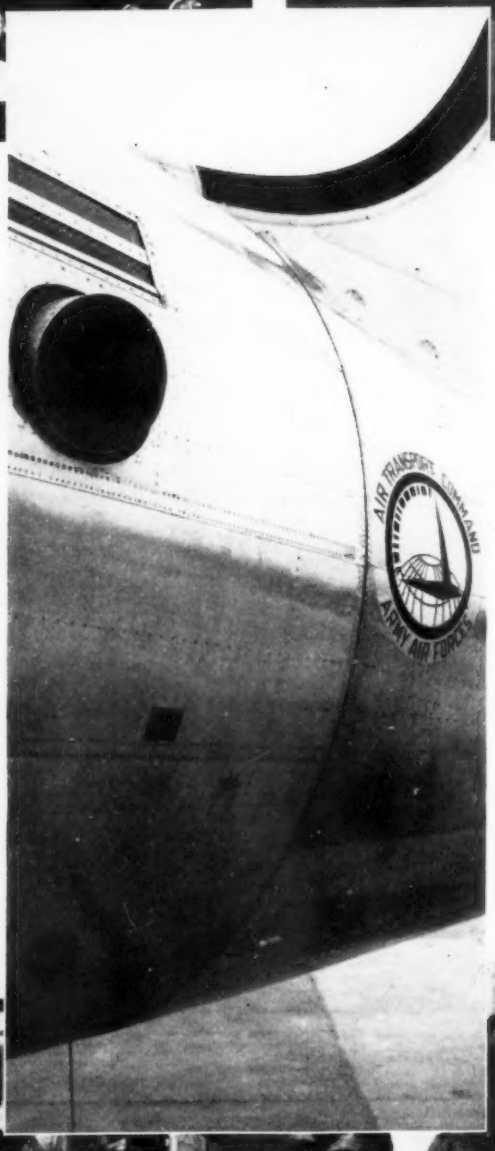


Underwater cameraman at left prepares to descend to check fish count at Bikini Atoll. Photographers above are preparing their cameras for high-speed aërial shots of the A-bombing.

These ultra high-speed movie cameras are mounted in the lower aft turret of the Boeing F-13 camera airplane and are remotely aimed and controlled.

The President's Evaluation Board for Atomic Bomb Tests. Seated, left to right: Representatives W. G. Andrews and A. J. May; Senators C. A. Hatch and Leverett Saltonstall. Standing, left to right: Fred Searles, Jr., New York mining engineer; Dr. Karl T. Compton, president, M.I.T.; Vice Adm. W. H. P. Blandy, commander, Joint Army-Navy Task Force One; W. S. Newell, president, Bath Iron Works; and Dr. J. R. Oppenheimer, University of Calif.

Members of Joint Army-Navy Chiefs of Staff Evaluation Committee discuss the Bikini tests. Left to right: Lieut. Gen. Lewis H. Brereton, commanding general, First Air Force; Gen. Joseph W. Stilwell, commanding general, Sixth Army; Dr. Karl Compton; Vice Admiral Blandy.



Bikini Chief Jomata Kapua studies a map to select a new home for his subjects. He rules 6 other atolls.

Natives of Bikini Atoll, below, sadly listen to the news that they are to be moved to other islands so that theirs can be used in the atom bomb tests.

Plowshares to Swords

The Record of the Industry-Ordnance Team in World War II

General Campbell's forthcoming book, "The Industry - Ordnance Team," is in no sense an autobiography but a comprehensive record of the trials and tribulations, as well as the accomplishments, of American Industry and the Ordnance Department in the gigantic task of arming this Nation and supplying arms and ammunition to an additional forty-three countries in World War II. But throughout this factual recital of some of the most stirring events in American history a series of revealing incidents shows the drive and efficiency of the author who modestly refers to himself merely as the quarterback of a great civilian-military team that, despite a very late start, outproduced the world.

IN the early days of the defense program, Lieut. Gen. L. H. Campbell, Jr., made his first contact with Donald Nelson. It was a brief telephone conversation that arose out of the following amusing but result-getting incident.

General Campbell had a batch of site letters for some additional critically needed plants. The letters had been carefully prepared after a week's tour of inspection and days and nights of the most exhausting kind of work. Nerves were frayed, tempers were short. After a lot of backbreaking work, the letters were finally ready for approval. Ordnance wanted approval in a hurry. General Campbell therefore sent a young lieutenant to the War Production Board with orders to park himself in a certain gentleman's office until approval was given.

In an hour or so Mr. Nelson called General Campbell requesting that he withdraw the lieutenant from his assistant's office so that his subordinate could transact his business with some degree of privacy. After a short but pointed exchange, Mr. Nelson and General Campbell reached a compromise. General Campbell promised to withdraw the husky lieutenant, and Mr. Nelson promised action on the site letters within twenty-four hours!

This is but one of a number of informative incidents recounted in General Campbell's book, "The Industry-Ordnance Team," to be published by McGraw-Hill Publishing Company on July 1, 1946. A limited number of copies will be available to members of the Army Ordnance Association at $4.00 a copy—a saving of $1.00 under the standard retail price.

When General Campbell first came to Washington in 1940 as a lieutenant colonel his assignment was to build an ammunition industry from the ground up. There was, at that time, no organization. In two days he secured a desk and a secretary and started in to build 73 Government-owned contractor-operated plants in all parts of the country which would eventually employ about 400,000 people and were expected to cost in the neighborhood of $3,000,000,000.

Perhaps the most outstanding chapter in the book deals with the organization of wartime industry integration committees. The lines of mutual assistance between industry and Ordnance were well developed by the early part of 1942, but intra-industry ties, such as the force of peacetime rivalry and competition, were relatively undeveloped. Part of General Campbell's job as a production expediter was to put highly diversified companies, large and small, into harness together.

Many companies found themselves far afield from their normal peacetime pursuits. They were awarded Government contracts for the production of unfamiliar items under strange and complicated wartime rules and regulations. Ordnance had to train, guide, and assist them individually during the initial stages of production and then weld them together into intimate groups for the rapid manufacture of specific Ordnance items.

ORDNANCE could not possibly have met its constantly changing and fluctuating requirements without the extreme flexibility afforded by this grouping of contractors. Specifically, the various integration committees made it possible to turn out thousands of units above and beyond individually rated plant capacities. By integrating all manufacturers producing a particular item, the excess component capacities, raw-material stocks, machine tools, and know-how of one company were utilized to offset deficiencies in other companies which, in turn, gave reciprocal assistance to the best of their ability.

Another ingenious method devised by General Campbell to increase production was the organization of machine-tool panels. Lack of a machine-tool industry of sufficient size to meet an abnormal wartime load was one of the most serious bottlenecks in the early period of the armament program. Following Pearl Harbor, the normal sources of machine-tool production were choked with orders from our allies, from our own aircraft and shipbuilding industries, and from the various procurement branches of the Army and Navy.

To break this bottleneck, General Campbell inaugurated an intensive search for existing machine tools wherever they might be located. Some success

was achieved in finding small plants with idle tools and equipment which were willing either to sell their equipment to prime contractors or to act as subcontractors for various components of ordnance matériel. Still other plants were located which were willing to perform various machine operations on parts sent to their plants. Much was accomplished, but there was a need for a national organization to handle this difficult problem.

General Campbell hit upon the idea of machine-tool panels. These panels would consist of civilian experts in the machine-tool industry. Machine-tool distributors of necessity knew intimately all plants within their respective territories, the types and ages of the equipment in these plants, and the skills of their operators and mechanics.

If these men representing this particular activity of industry could be made available to Ordnance from time to time, Ordnance would have complete and detailed coverage of all plants using machine tools, large and small, available for ordnance production. The first machine-tool panel was organized in the Chicago Ordnance District and, in a short time, similar panels were set up in other Ordnance districts.

As part of the Ordnance record, General Campbell cites the fact that during the latter years of the war Ordnance averaged better than $100,000,000 a month in awards to small plants. The total value of such contracts was more than $3,500,000,000. As of June 20, 1944, of 4,206 Ordnance prime contractors, 2,840 or 68 per cent were small plants.

In addition to prime contracts, of course, the small plant played an essential rôle in the war effort as a subcontractor. Many plants were ill-equipped to serve as prime contractors because of the complex nature of most Ordnance items but could and did do an excellent job on a component or an operation; others preferred to take subcontracts only.

During the course of World War II, Ordnance either replaced completely or radically improved 75 per cent of the basic equipment of our fighting troops and developed more than 1,300 new weapons. American industry has a large share in the credit for these achievements because speed in weapons' development was so imperative that General Campbell decentralized the greater part of Ordnance research and development work to industrial organizations, scientific societies, private laboratories and universities so that Ordnance specialists would have the immediate assistance of the best scientific talent in the country.

"During the course of World War II, Ordnance either replaced or radically improved 75 per cent of the basic equipment of our fighting troops and developed more than 1,300 new weapons. American industry has a large share in the credit for these achievements."

In a general way it might be said that the Ordnance Department possessed the vital know-how of arms manufacture whereas the major contribution of industry was in the field of mass production. In the production of artillery, for example, the Ordnance arsenals were at first forced to carry the major part of the production load; but as soon as commercial facilities rearranged their plants and retooled they carried the bulk of the load, and the arsenals, despite increased capacity, carried only a relatively small part of the maximum production program.

This was likewise true in the tank-automotive and other fields. From 1919 to 1933, Ordnance produced only thirty-three tanks. Meager appropriations made it possible to produce only 1,000 tanks from 1935 to 1940. But Ordnance knew what it wanted. The plans and specifications were ready when the defense program started in real earnest. Blueprints were rushed from Aberdeen Proving Ground to various civilian plants, and these, by the application of mass-production techniques, turned out 87,619 tanks from 1940 to 1945.

Quantity production was achieved by the Industry-Ordnance team by a highly effective use of man power and by the rigid conservation of materials. As a practical illustration, General Campbell recalls that in July 1942 it took approximately 3,000 men and women to produce a million rounds of caliber .30 cartridges a day. By January 1944, 18 months later, only 1,600 workers were required to produce the same quantity of small-arms ammunition.

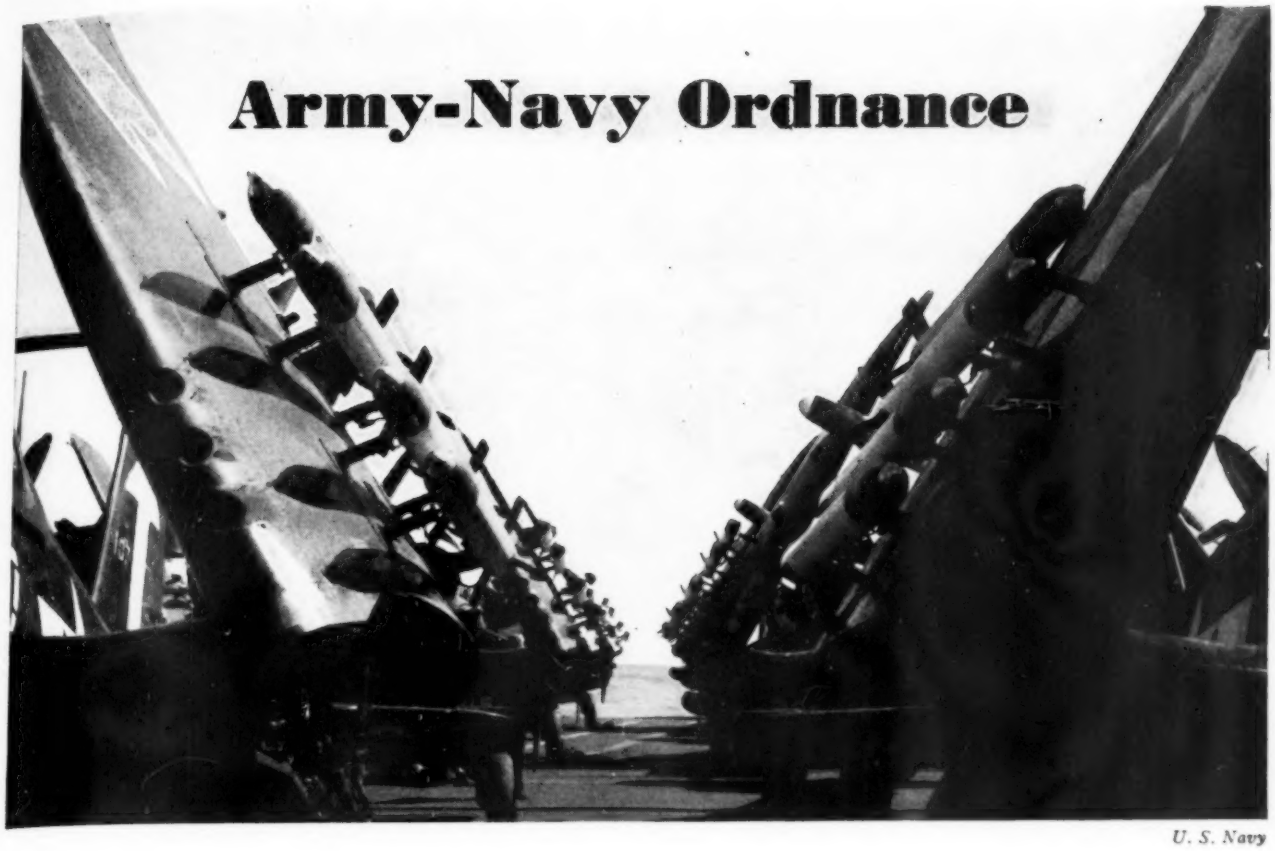
General Campbell devotes a highly interesting chapter to the subject of Lend-Lease. Vast quantities of Ordnance weapons, ammunition, and automotive equipment were sent to Great Britain, Russia, China, and other United Nations. Ordnance matériel sent to Russia totaled nearly three billion dollars. In addition to tanks, Ordnance sent 294,000 tons of explosives, 1,800 self-propelled guns, 135,000 submachine guns, 13,000 pistols, 1,200 half-track vehicles, and 8,200 guns.

ORDNANCE Field Service supplied some 2,000 major combat items to all theaters of war and about 700,000 different kinds of replacement parts that were needed to keep these items in first-class repair. This logistic department of Ordnance received or shipped by rail, highway truck, or air transport an average of slightly more than one ton of supplies with every tick of the clock, day and night, throughout the year.

In a concluding chapter, General Campbell outlines the high degree of coöperation that exists between the Ordnance Department of the Army and the Navy's Bureau of Ordnance. This is particularly true in research and development and in procurement. But General Campbell is of the opinion that the demands for technical superiority in modern war are so important that any compromise in design quality between the Army and the Navy for the sake of common procurement would prove very costly in lost lives and lost battles.

General Campbell's book makes interesting reading. Written in popular style, it is not only an excellent digest of Industry-Ordnance activities in World War II but an informal commentary upon men and events during the past critical years. General Campbell was at the center of the vast production effort that amazed the world. All those who, whether military or civilian, took part in this effort and all those who would like to know more about our stupendous home-front achievement will find this book an invaluable addition to their libraries.

Army-Navy Ordnance



U. S. Navy

Coöperation Was No Problem For These Services

by

Vice Adm. G. F. Hussey, Jr.

HAVING followed ordnance throughout all the shoregoing side of my time in the Navy, I have, of course, kept in close touch with the Army Ordnance Association, and I have regarded highly the standards that Association set for its own membership and the accomplishments which that membership produced. Toward the end of the grand tour which concluded my postgraduate course in ordnance, I had an all-too-brief month's duty at the Aberdeen Proving Ground. Fresh from our own proving ground at Dahlgren, I was able to note the differences in the problems each of us had to solve and to appreciate the validity of and the necessity for different methods of approach to those problems.

Quite apart from the technical knowledge which I absorbed at Aberdeen, a most treasured aspect of that duty was making the acquaintance of the chief proof officer, Maj. Levin H. Campbell, Jr. A few years later, when a cruise in the Bureau of Ordnance sat me at the ammunition desk, it was a great pleasure to find that the manufacturing officer at Frankford Arsenal was Lieutenant Colonel Campbell.

Those were the days when both services were getting into the manufacture of the mechanical time fuze and before private industry was sufficiently interested to take on that particular headache. Frankford Arsenal was the source of manufacture for both of us, and during those days of trying to make the damn thing tick I built up a hearty respect and a great affection for Colonel Campbell. He was always willing to go to the greatest lengths to solve our common problems, and in the long run he always succeeded.

With that as a background you can well imagine what a pleasure it was, when I relieved Vice Adm. W. H. P. Blandy as Chief of the Bureau of Ordnance, to know that General Campbell was across the river as my opposite number. There is no need to extol him as a master of ordnance, but I wonder if all realize the extent to which he was also a master of coöperation. Never once did I have occasion to go to him for help but what that help was made available, usually in far greater measure than was asked.

HOWEVER the recent conflict may be entitled by the historians of the future, certainly no one of them will go far wrong if he describes the war on the home front as a war of coöperation. The splendid Industry-Ordnance team which General Campbell led had its counterpart in the naval Industry-Ordnance team, often with the same players from industry. Having served in a technical section of the Bureau of Ordnance during the days of competitive bidding, I was accustomed to the necessity for guarding trade secrets closely and for ensuring that one manufacturer was given no inkling as to how his competitor was approaching a problem.

When I left my four-pipers (World

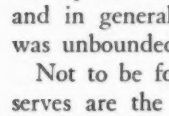
Admiral Hussey is Chief of the Navy Bureau of Ordnance.

War I destroyers) on patrol off Pearl Harbor and came back to the Bureau in May 1942, I found I was to be director of the Production Division. To my amazement, conditions were entirely different. Firms which had been bitter business rivals only a few months before would come in and literally roll their blueprints on the table, saying, "Here is what we know how to do. Will it help you or anybody else that's in this business? We want to do our part." With coöperation of that sort there could be no doubt as to the ultimate outcome of the war.

The service members of the naval Industry-Ordnance team were representative of the Navy as a whole. You are probably aware that ninety-five per cent of the officers and men who made up the Navy were members of the United States Naval Reserve. They came to us, particularly in the case of the officers, from their civil pursuits, adapting themselves to what many of them must have regarded as our peculiar ways and bringing to their jobs their particular talents and experience and in general an enthusiasm which was unbounded.

Not to be forgotten among the Reserves are the WAVES. It may perhaps astonish you to know that at the peak there were more WAVES—officers and enlisted—on active duty than there were officers and men in the regular Navy when I graduated from the U.S. Naval Academy in 1916. The WAVES did an outstanding job for us. The enthusiasm and energy with which they undertook their tasks were hard to match, and their attention to military courtesy set a mark for officers and men, Regulars and Reserves alike.

By comparison, the Regular officers were numerically only a handful. On them, of course, fell the responsibility for guiding the work of the Reserves along the established service lines. I should be particularly remiss if I failed to mention two quite small but very important groups of Regular officers: First, those who had been retired for one reason or another and who came back to active duty at the beginning of the emergency; secondly, those still on the active list on whom fortune had not smiled particularly in the matter of promotion.



Both these groups applied their experience and talents with an energy and devotion to duty that was an example for all. I can speak feelingly because I had the privilege of relying on a number of these officers who held important billets both within the Bureau and in its field activities. Without their loyalty and their most competent support there were many occasions on which I should have been literally at sea, and I shall treasure the memory of those associations as one of the bright spots in this war.

THE best will in the world to cooperate could have gone for naught, or at best it could have frittered away a tremendous amount of energy, had there not been sound planning on which to build. Far be it from me to maintain that the plans were either made or executed with one hundred per cent perfection, but in these days when there is so great a tendency to pick flaws in the way jobs were done, it seems to me worth-while to point out one or two aspects of outstandingly successful bits of work.

The Army-Navy Munitions Board is, of course, well known. I had the privilege of serving on several of its commodity committees during my cruise as chief of the Ammunition Section. The workings of one will serve to illustrate my point. The committee on smokeless powder and explosives, on which the working members were officers from the Ordnance Department of the Army and the Bureau of Ordnance of the Navy, totted up the requirements of both services and found immediately, as might have been expected, that the Army's requirements were far greater than the Navy's.

It was decided to lay the burden of meeting the requirements on the Army and, specifically, on Army Ordnance. The Chief of Ordnance established a branch of his Philadelphia Ordnance District at Wilmington, and there, with industry's help, plans were drawn for the plants necessary for the production of smokeless powder and high explosives.

On the basis of these plans the Army Ordnance Department obtained funds and procured some of the critical equipment, such as graining presses and the like. When the emergency came, those plans were put into effect, plants were built and operated by private contractors, and throughout the war the needs of both services for smokeless powder and explosives were met. Not only that, these same plants, in some cases modified and expanded, turned out also the rocket powder required by both services.

The rocket program is another outstanding example of the way the two ordnance activities coöperated. Two separate scientific approaches to the problems of rocket propulsion came up, more or less naturally, with two separate answers. The Army pursued one, the Navy pursued the other; and when it became apparent that for certain applications the Navy type offered advantages, a joint program was undertaken.

The Army supplied the rocket powder in either sheet or grained form, the Navy supplied the inert parts and the fuzes and did the loading and assembly. In a great number of cases the rockets which you have seen in the movies fired by Army planes against German and Japanese targets were Navy rockets containing Army powder.

Coming closer to home, the VT fuze, in which Eastman Kodak played an outstanding part, was a further striking example of how the services served each other. The application of the VT-fuze principle to a nonspinning bomb or rocket and to projectiles and spinner rockets with extremely high rates of rotation posed completely different problems. The Army took the first, the Navy took the second—each supplying the other with products tailored to the user's needs.

Those jobs, of course, could not have been done without the magnificent cooperation of both science and industry. But thanks to that coöperation the antiaircraft guns of our fleet had their effectiveness increased some threefold by the VT fuze which enabled the fleet to take on those kamikaze pilots and baka bombs which got past our amazingly competent combat air patrol.

The VT fuze—tailored for British and American guns and used with American Army fire-control systems—was to a large extent responsible for breaking the German buzz-bomb campaign against England. So effective was the VT fuze that, in the last week of the campaign, projectiles so fuzed accounted for seventy-nine per cent of the buzz bombs that reached the coast of England. The third striking application of the VT fuze came in its first use by land forces against land forces when in the desperate Battle of the Bulge the VT fuze used by American

artillery was a telling factor in throwing back Von Rundstedt's hordes.

The first of the examples I cited was the result of precise planning to meet known and calculated needs. The other two were a continuation of the same principles of coöperation by planning as the job went along. Both of them were successful; but had the needs been anticipated, the plans could have been made in a more leisurely fashion and the effort required to produce the end results could have been reduced. From these facts we can learn the necessity for continued planning while the lessons of this war are still fresh in our minds.

SUCH planning is already under way through the reconstituted Army-Navy Munitions Board. Under the competent chairmanship of Richard R. Deupree, of the Procter & Gamble Company, the Board is resuming its peacetime function of planning. As one of the subcommittees of the Board there has been set up the Joint Army-Navy Ordnance Procurement Committee. On the Army side, the committee members are the Chief of Ordnance, his Deputy Chief, and the chief of Industrial Service; on the Navy side, the Chief of the Bureau of Ordnance, the Deputy Chief, and the director of the Production Division.

Frankly, the members of the committee have been a little bit stumped as to what to put down on paper because the coöperative system of supplying each other has worked so exceedingly smoothly. Basically, all we can say is that for those items which are clearly common to both, the service having the paramount interest will procure and supply to both. For those items where changes are needed to meet the specific requirements of one user or the other, the procuring service will endeavor to incorporate in the basic design such modifications as will meet those needs without impairing its utility for the originator. Failing such a happy solution, modifications to meet the needs of one user will be undertaken concurrently with the production of the basic item as originally required.

It is, of course, apparent to all of us that in these days of a staggering public debt and an economy-minded country funds for our procurement will be exceedingly small. There will be no occasion for either ordnance service to come to industry and call for tremendous production efforts, but it is equally clear that unless preparations are made for such production, we shall be caught flat-footed by the next war.

The outstanding production achievements which supplied our fighting men on land, at sea, and in the air stemmed originally from basic research in the laboratories of the country. Much of that basic research had been done before the war, and the immediate wartime problems were of applied research, turning the fruits of fundamental scientific investigation to the solution of particular problems and from those solutions the development of devices and means for applying them in service.

"As the providers of weapons —offensive and defensive— we in Ordnance in both services have a wide-open field. The weapons which were in being at the end of this war— both our own and our enemies'—point the way to yet more fantastic devices in the future. Indeed, some of them were just around the corner when capitulation occurred.

"The allies and the Axis had weapons close to readiness for service use that employed then-untapped sources of fighting power. The day of Buck Rogers in the flesh is not far ahead of us, and the translation of fantastic dreams into workable weapons once again will call for the help of industry and science."

Side by side with industry, science laid down its peaceful pursuits, and the scientists of the country rolled up their sleeves and turned to solve our problems. Working alongside them, the engineers of the country caught the fruits of applied research and did their developing, while right at their elbows production engineers were preparing the production lines. As I have said, that system worked, but it was frightfully expensive. It was expensive in time, in man-hours, and in human effort. It was possible only because some one else held the line for us during the days before Pearl Harbor. Never again can we rely on a period of grace before the bombs fall. We must ensure that means are established and kept in being for solving in advance the problems which the fighting men pose for solution.

By nature and tradition America is a peace-loving country. Equally so, scientists are peace-loving individuals. Their natural bent is to those pursuits which will increase mankind's store of knowledge, further the ways of peace, and improve the standard of living.

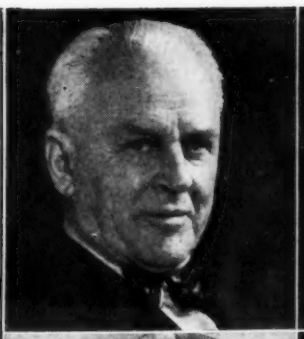
That is very much as it should be, but we cannot afford to allow scientists to wash their hands completely of a share in national defense.

If I have seemed to mention the scientists from universities and private laboratories, it is not because I fail to realize the competence of the scientists who man the laboratories of industry, nor the scope of their activities. We must be able to count on the continued help of the scientists in all fields of endeavor if we are to have a successful solution to our problems.

Equally, it is of vital importance that the laboratories of the Army and Navy be staffed by individuals as competent as those who man the laboratories of universities and of industry. Efforts are still under way to improve the remuneration and the standing of Government scientists, so that we may hope to retain some of the highly competent individuals who have worked with us during the war and to attract young men of promise.

AT the same time, until it can be demonstrated that the guided missile or the pilotless aircraft—whatever form it may assume—can accomplish the reduction of enemy strongholds and the exercise of control so won, it is my opinion that there will remain the necessity for the fighting man afoot—Marine or GI—to take and hold whatever territory may be needful to ensure victory. This calls for armed men, shipping to transport them, fire support, and the protection of the long lines over which their supplies must come. All these steps require weapons of the same general classes as were used in this war. No one of them can, however, be regarded complacently, but each must be checked for possible improvement.—*Address of Admiral Hussey before the Empire Post, Army Ordnance Association, Syracuse, N. Y.*

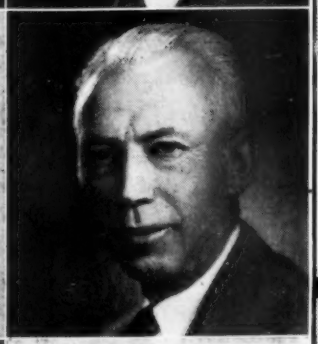
For Eminent Service We Salute—



Dr. Robert A. Millikan, Ordnance Research Center, California Institute of Technology, Pasadena, Calif.

W. E. Crocombe, president, American Forge Division, American Brake Shoe Co. Director, Chicago Post, A.O.A.

Maj. C. Stewart Comeaux, secretary, Sporting Arms and Ammunition Manufacturers' Institute, New York, N. Y.



Myron J. Hayes, vice-president, Eastman Kodak Co., Rochester, N.Y. Member, Fire Control Instrument Div. Committee, A.O.A.

Louis Schwitzer, president, Schwitzer - Cummins Co., Cincinnati, Ohio. Member, Cincinnati Post, A.O.A.

J. M. Skilling, E. I. Du Pont de Nemours & Co. Member, Artillery Ammunition Division Committee, A.O.A.

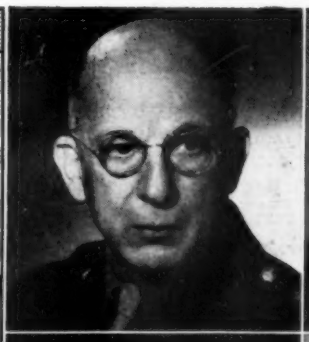
Ross Stewart of C. Jim Stewart & Stevenson. President, Texas Post, A.O.A.

Brig. Gen. A. B. Quinton, Jr., commanding general, Aberdeen Proving Ground. Member, Aberdeen Proving Ground Post, A.O.A.

Col. C. S. Robinson, Massachusetts Institute of Technology. Past president, Boston Post, A.O.A.

Edwin Pugsley, director, Hartford - Springfield Post, A.O.A.

These Industry-Ordnance Leaders

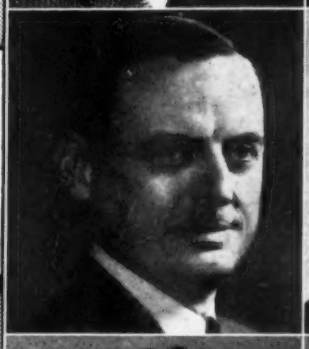


Maj. Gen. J. K. Crain, ordnance expert, European Theater of Operations. Member, Washington Post, A.O.A.

O. E. Hunt, General Motors Corp., Detroit, Mich. Director, Michigan Post, A.O.A.

Dr. Frank J. Malina, acting director, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, Calif.

Carl Bausch, Bausch & Lomb Optical Co., Rochester, N. Y. Former director, Empire Post, A.O.A.



Capt. Frank Jervey, small-arms expert, Ordnance Department. Member, Small Arms Division, A.O.A.

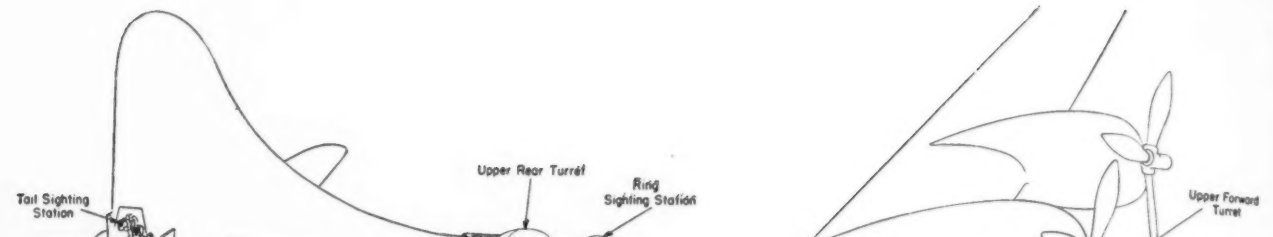
Col. J. K. Clement, former chief, New York Ordnance District. Charter member, A.O.A.

Col. R. R. Klanderman, Field Director of Ammunition Plants, Ordnance Dept. Member, Artillery Ammunition Division, A.O.A.

Henry N. Marsh, Hercules Powder Co., Wilmington, Del. Member, Artillery Ammunition Division Committee, A.O.A.

Morton P. Woodward, Procter & Gamble Co., Cincinnati, Ohio. Member, Artillery Ammunition Division Committee, A.O.A.

L. Iversen, Mesta Machine Co., Pittsburgh, Pa. Member, Artillery Industry Division Committee, A.O.A.



Sighting Stations on the B-29

The Remote Control of Aircraft Armament in Combat

G. A. Cook

MANUAL, remote control for aiming guns accurately to hit a moving target requires that the following sequence of events take place: (1) A visual indication to the gunner of the direction the sight must move; (2) Action on the part of the gunner in accordance with those indications; (3) Transfer of this action to a computer where certain corrections are added to the signal to compensate for the time required for the bullet to reach the target; and (4) The transfer of the modified signal to the gun turret so as to position the guns properly.

It is apparent that the accuracy required for each of these events is equally important, since the projectile will miss the target by the same number of feet for a one-degree error in aiming the sight as for a one-degree error in computing the proper correction.

Development and design of the sight or aiming means differs from the design of a computer, for instance, in that it involves consideration of a human being as part of the mechanism, an element sometimes unpredictable and highly emotional under conditions of use. The computer has the relatively stable requirement that definite data in the form of volts, current, etc., be resolved into a signal for positioning the guns. Since it is difficult to measure the reactions of a man in absolute units, the development of a sighting station must, in many respects, be based on tests using an average GI as a gunner.

The B-29 airplane is equipped with five sighting stations and five turrets located as shown at the top of this page. Four of the sights are of the pedestal type and are located in the nose, two side blisters, and the tail. The fifth sight is the ring-type as shown on p. 61. There is a gunner for each of these sights, and the coverage of each sight is sufficient to overlap and thus completely protect the bomber.

Basically, the sights have control of turrets as indicated in the box on p. 61. Each gunner can relinquish primary control of his turret by means of a selector switch at his station. The turret is then automatically taken over by the sight having secondary control.

One of the advantages of remote control armament on an airplane is that it imposes less drag than does the conventional inhabited turret. In a direct-vision sight, the blister at the sighting station must be at least large enough to permit the gunner to get his eye outside the skin line of the airplane. The principal problem in designing a sighting station is to arrange the components so that the blister size is a minimum. In designing the sight this was of paramount importance and, in some instances, required that the design

The B-29 pedestal sight.

Mr. Cook is in the aëronautics and marine engineering division, General Electric Company, Schenectady, N. Y.

be compromised with what would otherwise be optimum.

The first of these is the azimuth assembly, which forms the base of the sight and has two selsyn generators which are rotated by means of accurate gearing. The selsyns transmit an electrical signal corresponding to the exact azimuth position of the line of sight. The azimuth unit also has some of the auxiliary equipment of the sight, such as a rheostat for controlling reticle brightness, a switch for cutting the computer out of the system, and a stow pin for locking the sight in azimuth.

The second part is the elevation unit which also has two selsyn generators which rotate as the sight is moved in elevation and transmit an electrical signal corresponding to the exact elevation position of the line of sight. On this unit are the handwheels with which the gunner controls the position of the line of sight. The thumb of each hand rests easily on a trigger, and a slight pressure on either one will fire the guns. The action switch under the palm of the left hand must be depressed to complete the circuit between the sighting station and the turret.

If the gunner removes his hand from the left handwheel, the switch is in the open position, and his sight can no longer control any of the turrets. The turrets under his control are transferred automatically to one of the other sighting stations. Superimposed on the right handwheel is a smaller wheel with which the gunner makes proper range adjustment.

The third basic part of the pedestal station is the retiflector sight. This device provides a means of visually aiming the sight, and it also furnishes an electrical signal that is a measure of the distance to the target. It is necessary to know this distance, or range, because the corrections to be made by the computer depend upon it.

The means of obtaining a measure of the range is based on the principle that, within certain limits, the apparent size of an object is dependent on the distance to the object and on its actual physical size. Therefore in using the sight the gunner must know or estimate the wing span of the attacking plane previous to the actual attack.

Ring sighting station on the B-29.

On an inclined, clear glass plate the gunner sees the image of a series of orange dots in the form of a circle, and looking through the glass plate he sees the enemy plane.

Directly above the circle the gunner sees a number that he previously selected which represents his estimate of the wing span (in feet) of the attacking plane. It is the duty of the gunner to adjust the diameter of the circle to equal the apparent wing span of the plane. The adjustment of the circle size is accomplished by means of the range wheel shown. The gunner must also keep the plane centered on the circle of dots to properly position the guns.

The retiflector sight is equipped with sky filters for use when the light conditions in the sky are too bright for the gunner's eyes, a switch for using an auxiliary filament in the lamp, and a metal ring and bead sight for use in case of lamp failure.

Two gyroscopes constitute the fourth basic part of the pedestal sight. The purpose of the gyros is to measure the angular rate in azimuth and elevation that the sight is being moved as the gunner tracks his target. This rate is transferred to the computer as an electrical signal where it is in effect multiplied by the time of flight of the projectile. In order to measure accurately the angular rate of sight movement by means of these gyroscopes, the operator must move the sight smoothly. A jerky movement will result in an inaccurate rate measurement.

To facilitate smooth movement, the sight is equipped with inertia wheels geared to the selsyn gear train and driven through a friction clutch which permits slewing of the sight for getting on a target rapidly. In addition to the flywheels, a stationary felt shoe, pressing against a moving shaft in both azimuth and elevation, provides a damping effect which adds to the smoothness of tracking.

The ring assembly consists of two concentric rings. The outer ring is attached to the airplane, and the inner ring serves as a support for the other parts of the sight. The inner ring is rotated on ball bearings supported by the outer ring.

The control unit is attached to the inner ring and carries the hand grips for moving the sight in azimuth and elevation, the reticle rheostat, computer switch, and stowing pins. The handgrips rotate about the center of the shaft connecting them, and this motion is transmitted to the sight yoke as elevation movement.

The azimuth unit mounts on the inner ring and contains gearing for the azimuth selsyns. The unit has an external gear which meshes with an internal gear on the outer ring. The elevation unit is a separate gear box, carrying the elevation selsyns with necessary gearing for transmitting the elevation position.

The sight yoke is supported between the azimuth and elevation gear boxes and pivots about a horizontal axis to provide elevation motion. Mounted on the yoke is a retiflector sight like that on the pedestal sight, but the reflecting plate is rotated ninety degrees.

Position of Sighting Station	Turret Controlled	
	Primary	*Secondary*
Nose pedestal	Upper forward Lower forward	None
Side blister pedestals	Lower rear	Lower forward Tail turret
Tail pedestal	Tail turret	None
Ring sight	Upper rear	Upper forward

Primary and secondary control functions of the sighting stations on the B-29 Superfortress bomber.

Universal Training for Peace

The People's Preparedness Is the Best Guaranty of Security

Col. John G. Booton

THERE is one thing that is always a little curious to those who have spent their lives in planning the defenses of our country against the risks of war. That is the apathy of our people as to the who and the why of the persistent and vicious attacks that are made against any plans for our adequate preparedness. They apparently do not realize that the querulous inquiries, "Why do it now?" or "Why bother us?" and "What's the use?" are generally planted among us from sources and influences that, for purposes of their own, wish to make our country weak, helpless, and confused.

Such sources always profess to see in any plan for our defenses the genesis of some wicked scheme against the liberty, freedom, or welfare of our own people or those of a neighbor country. Their supposed perceptions are then carefully spread among the unthinking, whose opinions are formed for them by headlines and slogans. In their attacks it is assumed and argued that the creation of any means or implements of defense is either proof of the intent to use them wrongfully or that their possession will generate such a purpose.

Such agitators tell us, in effect, that our people, under our form of government, cannot be trusted with the means for their protection. Of course for the form of government which any of these groups hopes to force upon us, ample means for defense would be essential. But for our present form, no! It would be far too dangerous for us to have it!

To our cost, too many of our people, in the past, have believed such statements.

The same bombardment is again under way with the same appeals to passion and prejudice against any system of preparation and training that would give our citizens an understanding of the risks of war, of how to avoid them, and how to meet them if they cannot be avoided. These advocates are now directing their forces—and their herds of gullible followers—toward the defeat or delay of any effective plans for universal training against the risks of war.

They oppose any plan which promises to avoid the errors and weaknesses that led us into the last war and made our safe emergence so costly and, at times, so seriously doubtful. The variety of reasons for their concern, which they put into the mouths of any readily gullible supporters, are too often but a camouflage for the main purpose, which is to prevent any plan under which our people may acquire a healthy understanding of the risks of war and what to do if we should be unable to avoid them.

"The lesson of Pearl Harbor, which is there for all to read, is that our people were so little aware of our danger as to discourage any positive measures to defend against it. While we may criticize particular leaders for the details of their actions, the plain fact is that no one in authority dared take any positive action which might disclose to our people that he really feared the war which was almost upon us."

In discussing universal training as a means of assurance against war, which is the purpose to those who urge it, one approach to its consideration is to state the arguments of those who are opposed and to examine them in turn as they apply to our past wars and the one just ended. One common argument is that with the advent of radar, rockets, the VT fuze, recoilless guns, jet-propelled planes, and the possible uses of atomic energy, we do not know what kind or how much defenses we may need.

That is true. General Eisenhower doesn't know. General MacArthur doesn't know. Each of these would have an opinion based upon the uses of the devices that have so far been developed. But no one can tell what they will lead to in the coming years. So we must plan a system of defense which can be changed to meet new weapons or methods of warfare as they develop.

OUR military leaders must be, in effect, doctors of defense, permitted to speak to an understanding people when some change in military equipment or method requires a change in our system of defense. But they must speak to an understanding people, otherwise their words will be beaten down, as they have been in the past, by the combined efforts of the ill-assorted groups of would-be Quislings and those who thoughtlessly help them undermine any measures needed for our national safety.

We think this understanding can be developed best by a system of training under which every citizen spends some time in acquiring a sound basic knowledge of the current means and methods of warfare. General Washington, in his time, thought likewise.

Similarly, we do not know the political situations that may develop from the attempted organization of the world for peace. It must, in the long run, depend upon force. There must be sufficient force to discourage any group or country that might be tempted to challenge the peace of the world. We must be ready to provide such force as is needed now, or a year from now, or ten years from now, if we are to have the kind of peace and security that we desire. We can have this only if enough of our people understand not only the weapons that may be used but also the full significance of any rising political threat that might cause them to be used against us. A year from the life of each citizen does not seem too much to ask for providing a background of knowledge among our people of matters which may so vitally affect their future.

The lesson of Pearl Harbor, which is there for all to read, is that our people were so little aware of our danger as to discourage any positive measures to defend against it. While we may criticize particular leaders for the details of their actions, the plain fact is that no

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one in authority dared take any positive action which might disclose to our people that he really feared the war which was almost upon us.

DAVID LAWRENCE writes: "You and I are to blame—yes, you and I and the Congress and the President as well as the Army and Navy—for what happened at Pearl Harbor and before. This means primarily that the American people are to blame because of their indifference to air power as a means of preparedness, indifference to the issues of foreign policy and the ways by which we gradually became involved in war, indifference to diplomacy's vicious habit of keeping the facts of international affairs from the people until it was too late for corrective processes to be set in motion."

If we wait and wait and wait to find out exactly what we may need, we can again wait ourselves into another Pearl Harbor—or worse—before we find out what is needed to defend against it.

Another objection that is frequently made to universal training is its possible effects upon the youth of the country. Its opponents conjure up a picture of a hapless youth, torn forcibly from his happy home and chased from morning till night up hill and down dale by a hard-boiled drill sergeant teaching the mechanics of dealing sudden death. They picture the youngster coming out of this with nothing left but the distilled essence of savage cruelty. Actually nothing of the kind is intended or happens.

It it essential that the trainee should acquire an understanding of the capabilities and limitations of men and machines under field conditions. We do not know of any way to teach this except for each one to try it for himself until he has fully developed his own capabilities and his knowledge of what others can do. The use of a slide rule or a table of logarithms is taught in the same way. You may remember with some discomfort what a chore it was to learn the multiplication table and its uses. We know of no way to teach such things except by practice until a ready skill is acquired.

Modern warfare requires the practical use of equipment and methods drawn from almost every known field of science. It might be noted that many of the devices and methods are adapted from those developed or usable in civil life. An early general knowledge of their existence may well serve as an invitation for technical schooling to master their principles and develop an understanding of all their applications.

It has also been urged in opposition to military training that young men away from home influences will be led into antisocial habits and conduct. If this were a valid reason for rejecting the benefits of universal training, it would apply equally to sending young men to college. As a matter of fact, we in the service find little difference between the behavior of young men in barracks and young men in college. We are as much concerned as the dean of a college that they do not bring discredit upon us by misbehavior in puolic or violate the peace and liberties of their fellows by misbehavior in barracks.

"Our military leaders must be, in effect, doctors of defense, permitted to speak to an understanding people when some change in military equipment or method requires a change in our system of defense."

We suffer from the fact that the misbehavior of a single man in uniform will spread the story that the whole Army or Navy has been in town on a "bender." Similar behavior of a civilian would be taken as a matter of course. Let us assure you that we will do all we can to teach peace and good behavior, both in the groups we control and in international affairs.

One writer against universal military training argues that the use of the word "compulsory" is an admission that it would prove ineffective unless force were behind it. He argues that this would be a violent reversal of previous American conceptions of liberty. But he seems to forget that we have compulsory taxation, we have compulsory schooling, and we have compulsory obedience to the laws which we make for the protection of our citizens and their property. Compulsion is neither new nor strange in a democracy in enforcing the measures we take for the common defense or the general welfare.

General Washington did not seem to think it a violation of the liberty he had done so much to establish, when he wrote: "It may be laid down as a primary position and the basis of our system that every citizen who enjoys the protection of a free government owes not only a portion of his property but even of his personal services to the defense of it." He wrote further: "In proportion as the structure of government gives force to public opinion, it is essential that public opinion be enlightened."

From the wisdom of his experience he saw that to have peace we must have both the knowledge and the power needed to preserve it. We hope that our country will at long last heed his words of wisdom and warning and make effective the general military training that he so strongly urged.

It has always been the object of those engaged in international intrigue to prevent such general interest in the means and methods for an attack upon us and in the defenses which we should prepare against it. Behind even the most innocent and persuasive ideas for discouraging the interest of our people in military means and methods could almost always be found the bloody and venal hands of some organization seeking to lessen our power for peace and stability. Many innocent people were deceived by them and have become the front for violent and deadly attacks upon every means by which we could protect ourselves and our country.

Eugene Meyer, publisher of the *Washington Post,* in a recent appearance before a committee of the Congress called attention to the "well-organized" opponents of military training who were flooding congressional mail with protests against its adoption. "In my personal judgment," he commented, "the opposition is the same kind and from the same sources that prevented our being earlier and better prepared for war." He said further that he was unable to understand "the country trusting the people who, before the war, continuously undermined the program for training and preparedness which undoubtedly encouraged dictators to attempt world conquest and which certainly retarded our ability to defend ourselves and end the war more quickly."

Then we have the sneering inquiry from the opponents of universal training as to the country or group of coun-

tries from which we expect an attack. Naturally, we do not know. We cannot tell what may be the world situation a few years from now. Those who make this inquiry generally eliminate Great Britain and France. They cross out our late enemies, Germany and Japan, because they are to be made helpless.

Finally they get around to Russia as the only country against which we could possibly urge the maintenance of our defenses. One writer, climbing the heights of rhetoric, comes to the peak with this gem of wisdom: "An armament race with Russia, including the increased production of children to grow up and bear arms, doesn't seem a wise project for the United States to undertake."

It seems to be forgotten that a few short years ago Germany was supposed to be struggling to pull her economy out of the defeat of the last war. It seems to be forgotten that, when she was taken over by a funny little man named Hitler, his delusions of grandeur for himself and his country were, to us, but an international joke. Dangerous to us? Not a chance!

And the Japanese? They, too, were a funny little people who painted flowers on pottery and had been exploiting China for years without much success. Dangerous? Not to big, strong us!

But when the war began to come near our shores on both the Atlantic and the Pacific, we would have been all too glad to have found ourselves with reassuringly powerful defenses, even if they had been developed against the Prince of Pilsen and the Sultan of Swat. We didn't have them. World events might bring upon us an even more urgent need if we must wait to know who, what, when, and where before we begin to build against our possible needs.

I WOULD like to quote from a paper, "Case Study of a Defeated Nation," which was based on a study of the defeat of Germany: "A nation can contribute heavily to its own defeat by underestimating the will and ability of its enemies—and potential enemies—to wage war. An attitude of easy self-confidence leads to blunders in strategy, inadequate demands upon the people and the economy, and stifles the development of those very weapons upon which security must rest. Even more important, such incomprehension of the enemy — and potential enemies — permits a nation to commit itself to policies and engagements which can jeopardize its very existence."

While this was written about Germany, it describes only too well our own situation at some periods of the war. In fostering pride of accomplishment that we were able to overcome the almost impossible handicaps we had placed upon ourselves by lack of preparedness, we are prone to forget that vast groups of our enemies were beaten down and bled white against allies that they chose for us.

In our self-satisfaction that we grasped the opportunity to help, and have done most remarkable things in producing and transporting some of the means for warfare, we are prone to forget the enormous weight of man power and equipment thrown on the enemy by others. The one who added the straw which broke the camel's back is known to fame in song and story. It has long since been forgotten who piled on the load to which he added the straw that caused the camel's downfall.

Some future enemy may not choose our allies so unwisely. It would then be essential that we pile upon him a much earlier and much greater load if his back is to be the first to break. We should have it ready for whoever shows signs that he might be coming at us with malicious purpose.

Then we have the argument that the creation of an adequate system of military training will tend to make us quarrelsome and difficult in our relations with our neighbor countries. One writer, tilting with his mental windmill, generates the thought that "although we have no present quarrel with Russia, and can foresee no reason why there should ever be one, we can easily create one, and our peacetime conscription is an effective step in that tragic direction."

We think we would have a vastly improved understanding of why wars happen and what to do to prevent them if all our people were made aware of what is essential for their safety. We don't believe that an adequate and well-considered insurance policy will lead us to set fire to the house. It is only a bankrupt nation that is tempted to stretch its insurance to the limit, then start the fire to see what it can gain from the salvage.

Actually a study of our past wars, including the one just ended, will show that we have been backed blindly into most of them by misguided and poorly informed public opinion. We have muddled through them with average groups of our people who, at times, wanted to go home much more than they wanted to go on with the fight. In too many cases, part of our fighters have been poorly trained in the teamwork essential to avoid disaster in battle.

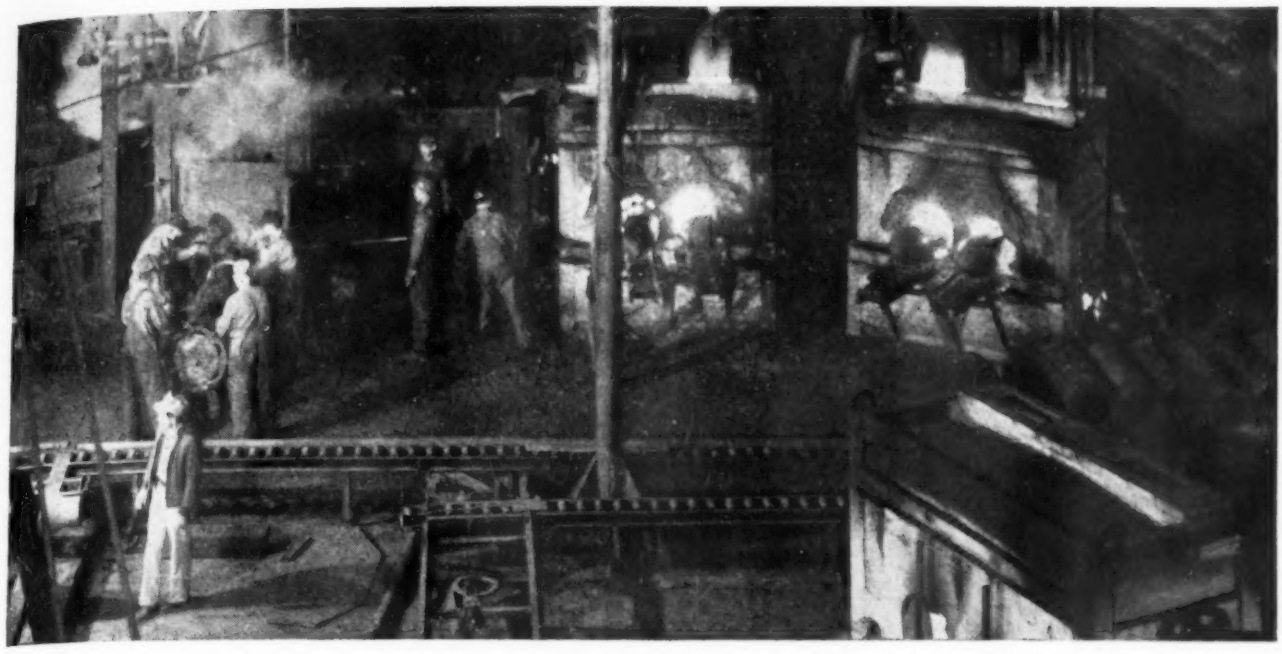
MUCH of this is glossed over or buried in the versions of our history which have been the early reading of our children. It steeps our wars in glamour, teaches little of the political confusion that brought them about, glosses over our mistakes in preparation and operation, and leaves the impression that every one concerned with them—on our side—was little short of Superman.

Thus many of our people grow up thinking that when some hated oppressor turns to put his foot on our necks, our mighty Army and Navy, backed by the millions who will spring to arms overnight, are but waiting for the word to throw their weight upon him and crush him forever.

With universal training we hope to reach all our people with a realization that it is their duty as citizens to understand how wars are invited and what enormous and difficult undertakings they can be. We hope to be able to treat our wars for what they were,—desperate, disagreeable, wasteful, and dangerous episodes in our history, against which we have never been prepared, politically or physically, either for their avoidance or their resistance.

We hope, with universal training, to make sure that all our people will be aware of our past mistakes, both in our failures to avoid wars and in being forced to struggle through them with hasty and wasteful preparations that should have been made long before.

It is true that such a program will take some of our time and money. Despite all our protestations, maybe we really mean to give only lip service, good resolutions, and easily broken promises to the cause of peace. If we really mean to treat war as the scourge that our people should know it to be, we can do no less than start a program for teaching every citizen all he can learn about its incidence, its avoidance, and what each should do when it cannot be avoided.



Industry in World War II

II. The Record of the Darby Corporation, Kansas City, Kans.

Col. Clyde H. Morgan

This is the second of a series of articles on the achievements of American industry in World War II. The story of the Du Pont Company was told in the May-June issue. Here is an account of a small corporation in the Midwest whose courage, imagination, and skill produced bombs, landing craft, and locomotive boilers for American victory ashore, afloat, and aloft.

MODERN war, no less than modern peace, is applied machine-tool power. Only by development of our industrial capacity can our Nation be strong, and only by our strength can we be free. Only by a strong and free America can the world look forward with hope and confidence to the dawn of a great era of peace and prosperity.

The integration of a nation's land, sea, and air forces is the culmination and direct fruit of its collective industrial effort. This industrial power resolves itself into men, matériel, and machines. All industry, large and small, played its part in the contribution to final victory. Some plants produced the ammunition, others the ships, and many made the aircraft which filled our skies. Only a few of our large corporations were privileged to contribute to all phases of our armed industrial effort. It is unique when we find a relatively small facility making vital parts for each service.

Stranger still is the circumstance that this plant, located in mid-America on the rim of what map makers a century back termed "The Great American Desert," fabricated ocean-going boats which traveled under their own power to engage in deadly combat in the remote regions of the fabulous East Indies.

The Darby Corporation of Kansas City, Kans., was organized in the 'twenties. The variety of its production covered the entire range from barges and steel bridges to metal caskets and mooring buoys. The pre-Pearl Harbor defense work consisted of the manufacture of submarine mines, emergency lock gates for the Panama Canal, and other related items. These contracts served an ideal function as educational orders for the more essential production yet to come.

One of the first strictly war orders involved the production of nearly 40,000 of the 1,000-pound semiarmor-piercing aircraft bombs. At the start of this contract there was available plant space, sufficient capital and credit, and an earnest inclination to do everything possible in expediting the war effort. However not a single piece of equipment required for the fabrication of the bombs was on hand, and all personnel were completely inexperienced in such production. A round-the-clock effort was required to overcome these deficiencies. Time meant everything, and the production layout depended mainly on the equipment which could be obtained immediately.

The entire country was screened with the result that secondhand steam hammers and drop hammers were installed and converted in the forge shop to shape the noses and tails of the bombs. The heat-treating furnace was built on

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the spot, largely from secondhand steel. This was operated early in production with only a visual pyrometer for temperature control—but meantime bombs were produced. Large turret lathes were unobtainable, so single-purpose hydraulic facing heads were purchased and installed on supporting beds at the plant.

Since normal sources for tools and material were flooded with orders and unable to make immediate deliveries, the various small machine shops and even garages were screened for required alloy material and cutting tools. By such expedients and by the ingenuity of the shop personnel it was possible to have the bomb line established on a production basis within less than three months of receipt of the contract.

Serious difficulties arose when cracks developed in forming the bomb nose section. Ultimately it was found that by chamfering the inside edge of the tubing prior to forging the cracks could be eliminated. The nose-forging time was reduced from two minutes and fifteen seconds to less than one minute per bomb.

After six weeks' operation it was necessary to shift to carbon-manganese alloy tubing due to the shortage of molybdenum. Likewise due to short supply and WPB regulations no substantial backlog of work in process could be maintained. Therefore the contractor quickly had to provide equipment for rapid quench and draw or be forced to shut down the line.

Since air draw furnaces were not procurable and, in any event, would cost between $50,000 and $75,000, it was necessary to proceed with the design and local construction of three salt pots —each about four feet in diameter and six feet deep—with a capacity of four bombs per pot. These were installed in a very short time and not only proved highly satisfactory in producing the required physical properties but effected a substantial economy in the critical amount of floor space available.

Unable to secure proper alloy screws for forcing the tubes into the dies, the contractor purchased old railroad-car axles which were then forged and machined. They functioned quite satisfactorily and relieved a serious breakage problem.

The painting difficulty was solved by routing the bombs from the heat treatment to the shot blast to the facing heads for machining and thence to the wash tank and paint booth. Appyling the paint to a relatively warm bomb directly after the steam and salt wash rather than to a cold bomb solved the painting problem.

LABOR and loading time were saved by shipping the bombs in a vertical position. This resulted in shipments arriving at the loading plants in better condition with less movement and no damage in transit. The base plugs were shipped in separate containers which served as a bulkhead in the center of the car and saved a removal operation at the loading plants.

In addition to the 1,000-pound semi-armor-piercing bombs, Darby also fabricated cases for the 4,000-pound blockbuster bombs. The construction of these was entirely different. On these bomb bodies there was no forge work; sections were pressed out on hydraulic presses and welded together—a procedure ideally adapted to facilities already available in the plant. The major equipment addition necessary for these large bomb cases was a 250,000-volt portable X-ray machine which was also used extensively in checking welds on other war products both for Darby and other near-by war plants.

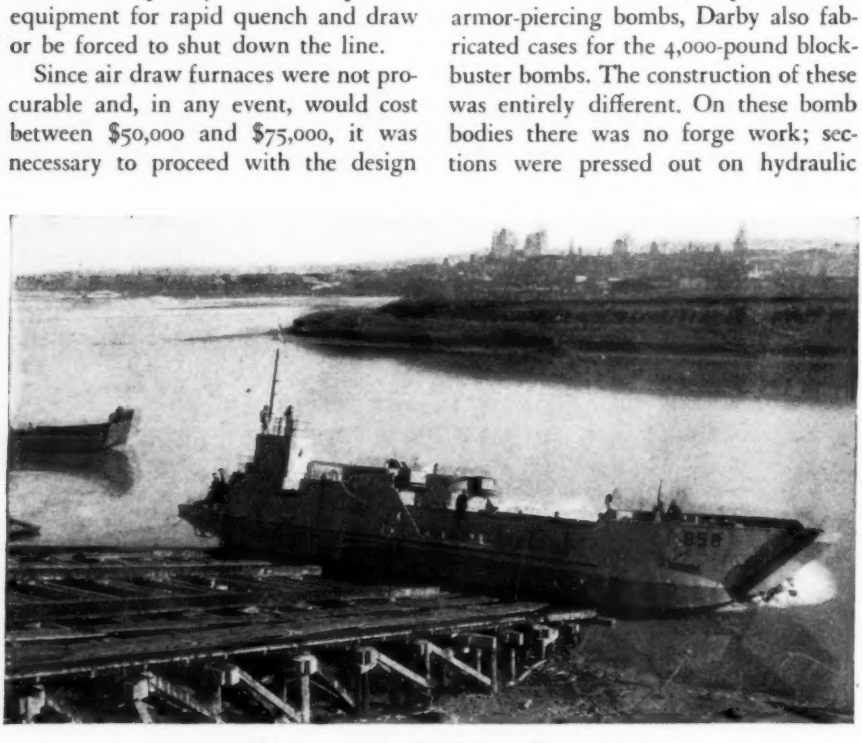
The production of landing craft for our sea forces provided romance along with many a headache. The first contract for landing craft was received in the spring of 1942, and the first completed vessel was delivered to the Navy on August 17, 1942. This contract was for the construction of 105-foot LCT-(5)'s which were all-welded shallow-draft tank-landing craft.

This initial program was followed in quick succession with Navy orders for LCM(3)'s—a 50-foot landing craft—and LCT(6)'s, enlarged versions of the LCT(5)'s. Even before orders for these ships were cleared from the yard, the Darby Corporation began turning out numbers of the LCM(6), a redesigned and lengthened LCM(3).

The building of the large LCT's was something of an innovation in a shipyard so far from salt water, and when the Darby Corporation in Kansas City was first considered as builders of such invasion craft, it was feared that the vessels could not be moved to sea once built. The LCT's dimensions are 105 to 115 feet long and 32 feet wide.

The Missouri River has a closed navigation season and considerable ice during the winter months, but this did not worry the company or the district Army engineer too much. Darby produced a considerable fleet of these invasion vessels and huddled them together. Then the Army Engineers let sufficient water out of the Fort Peck dam to raise the river level about six feet, and the fleet sailed seaward without difficulty. Fort Peck took years to construct and is the largest earth-filled dam in the world, located in Montana far from the Darby shipyard. It is unique that a dam should in this manner demonstrate the possibilities of Missouri River navigation.

But to get back to the beginning: Before the landing craft could even be started, land at the mouth of the Kaw River had to be cleared, filled, and built into an inland shipyard. Four



Launching a seagoing LCT(6) at Kansas City.

types of landing craft were built and tested here and finally delivered to the Navy.

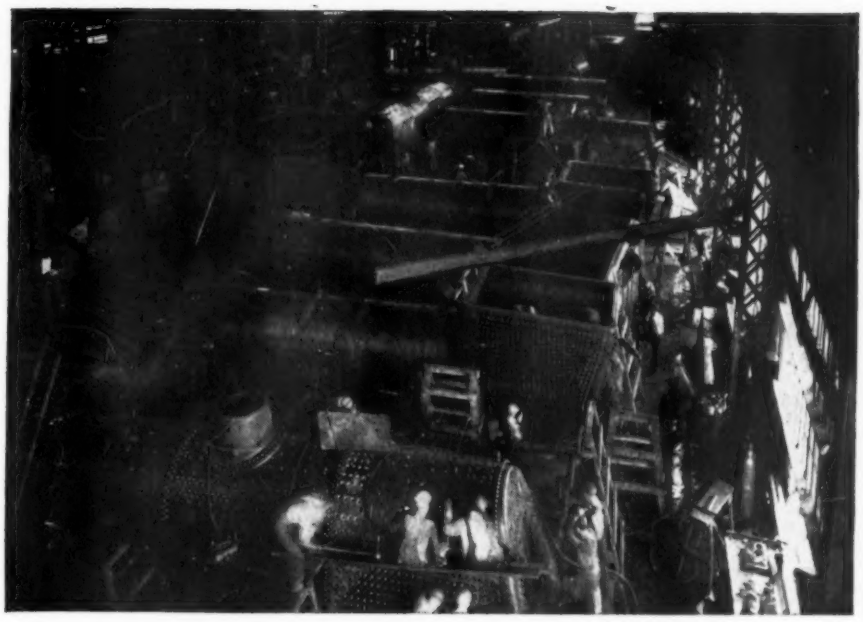
THE LCT invasion vessel was fabricated in nine all-welded sections of mild-steel plate. Besides the hull sections there were certain supplementary sections such as four deck houses, two forecastles, and a pilot house. All jigs for panels, frames, and the master jigs designed to release the work easily after being welded (a considerable problem at the start) were designed by Darby engineers. Jig sizes were greater than the finished fabricated dimensions to allow for shrinkage per section. They were given 3/8-inch overage on longitudinal and transverse directions.

Several thousand plates were involved in the fabrication, all being sheared and burned to tolerance nearing 1/64-inch and in many instances even more precise. More than 2,000 fixtures and fittings were also involved in this assembly. These included a tremendous amount of plumbing and electrical wiring and fixtures. Burning was done with acetylene, and welding was done electrically.

The LCT was fabricated from subassemblies finally formed into three main sections, aft, center, and forward. Of all-welded construction, the varied sections were welded upside down to gain the advantage of downhand working. They were then turned upright by a 25-ton crane and moved to the erection ways. The three sections were bolted together and started down a production line similar to that used by automobile manufacturers. The vessel could later be unbolted at the three joints for easier handling or to facilitate transportation.

During its busiest time the shipyard maintained three production lines—one of the LCT(6) and two of the LCM(3). The LCT(6)'s were carried on two sets of narrow-gauge railroad tracks 1,000 feet in length. Four-wheeled dollies traveled on these tracks, there being four of them to the assembly of each LCT(6). Various additions were made to the hull as it moved along the line and into an enclosed shipdrome where the finishing touches were applied and the painting done. After passing through the shipdrome, the vessels moved into position for launching and were sent down the ways into the Kaw River.

The LCM(3)'s and LCM(6)'s were also launched, given a trial run, hauled out again, and loaded on railroad cars for shipment to coastal points. Once launched, the LCT(5)'s and LCT(6)'s remained in the water for delivery by river and canal either to the East Coast or to the Gulf. All vessels that left the shipyard were complete in every detail and ready for combat duty.



Locomotive boiler assembly line at the Darby plant.

Although Darby was still building landing craft on V-J Day, the shipbuilding program had slowed down some, and additional work had been brought into the shipyard to make full use of the facilities there. The organization utilized the shipyard facilities in the repair and modification of hulls for General Sherman tanks and also did modification work on LVT(3)'s (amphibious armored vehicles) for the Navy.

In addition to the production of material for our air and sea forces the plant helped make locomotives capable of transporting the equipment to the seaboard. In this field the manufacturer had prior experience in the fabrication of boiler casings, condensers, and various riveted or welded tanks. Therefore the initial orders for locomotive boilers found the company well trained and experienced in such production. Orders for this type of material first were received in the spring of 1944.

Boilers manufactured were for the 2-10-0 type locomotive, commonly referred to as a Decapod. Primarily these locomotives were for Russian railroads and were of the heavy-duty wide-tread type. Here again the line method of production was established in the plant, and the orders were filled ahead of schedule.

IN addition to the actual production of bombs, ships, and locomotive boilers, the corporation was actively engaged in various development projects for both the Army and the Navy. These included mechanized tracked mine exploders, new types of tank-landing craft, and various other items. This work was carried on by the engineering and work crews at the same time that regular production was going on. Since V-J Day the organization has been active in helping to develop various types of steel storage containers to preserve our surplus war weapons for a possible future emergency.

The Darby Corporation is rightly optimistic for the future. Located in a rapidly expanding industrial region in the heart of America and surrounded by a thriving agricultural area it feels the future is limited only by its own enterprise and ingenuity. Labor and management together are planning a definite goal for peacetime production in the same spirit and energy with which they prosecuted the war.

It is their fervent hope and prayer that we shall never again be engaged in another world conflict with its tragic losses and wasteful expenditure of our national resources, lives, and labor.

ORDNANCE ROLL OF HONOR

THE following Ordnance officers have been awarded the Distinguished Service Medal (home address and last service assignment is given throughout this list where available):

MAJ. GEN. G. M. BARNES, Washington, D. C.; chief, Research and Development Service, Office of the Chief of Ordnance.

MAJ. GEN. C. T. HARRIS, JR., Mexia, Tex.; commanding general, Aberdeen Proving Ground, Md.

MAJ. GEN. RUSSELL L. MAXWELL, Vienna, Va.; headquarters, AAF, Washington, D. C. (Oak Leaf Cluster).

BRIG. GEN. WALTER P. BOATWRIGHT, San Francisco, Calif.; Office of the Chief of Ordnance.

BRIG. GEN. ROSSWELL E. HARDY, Washington, D. C.; chief, Military Plans and Training Service, Office of the Chief of Ordnance.

BRIG. GEN. H. R. KUTZ, Washington, D. C.; former chief, Military Plans and Training Service, Office of the Chief of Ordnance. (General Kutz also received the Legion of Merit.)

BRIG. GEN. BURTON O. LEWIS, Portland, Maine; commanding officer, Atlanta Ordnance Depot, Ga.

BRIG. GEN. GORDON M. WELLS, Mapleton, Iowa; chief, Artillery Division, Office of the Chief of Ordnance.

COL. IRVING A. DUFFY, New York, N. Y.; special assistant to the Chief of Ordnance.

COL. THOMAS H. NIXON, Gettysburg, Pa.; headquarters, European Theater of Operations.

COL. WALTER W. WARNER, Poughkeepsie, N. Y.; headquarters, Second Army, Memphis, Tenn.

THE following Ordnance officers have been awarded the Legion of Merit:

BRIG. GEN. RALPH S. CHAVIN, Washington, D. C.; U. S. Forces, China Theater.

BRIG. GEN. RICHARD C. COUPLAND, Washington, D. C.; Headquarters, AAF, Washington, D. C.

BRIG. GEN. GUY H. DREWRY, Capron, Va.; deputy director of matériel, Army Service Forces (Oak Leaf Cluster).

BRIG. GEN. BETHEL W. SIMPSON, Lansing, Mich.; commanding general, Ordnance Training Center, Camp Santa Anita, Calif.

COL. FRANK J. ATWOOD, New York, N. Y.; chief, Rochester Ordnance District.

COL. GORDON C. BAIRD, Rochester, N. Y.; Office, Chief of Ordnance—Detroit.

COL. JOHN C. BEATTY, Portland, Oreg.; executive officer, Watervliet Arsenal, N. Y.

COL. WARD E. BECKER, Virginia, Minn.; Ordnance Research and Development Center, Aberdeen Proving Ground, Md. (Colonel Becker also received the Air Medal, Bronze Star, and Oak Leaf Cluster to Legion of Merit.)

COL. HENRY T. BODMAN, Washington, D. C.; Control Division, Office of the Chief of Ordnance.

COL. EARLE D. BOTTOM, Dallas, Tex.; Office, Chief of Ordnance—Detroit.

COL. ROBERT G. BUTLER, JR., Middleboro, Mass.; Manhattan Engineering District.

COL. JEROME D. CAMBRE, Spokane, Wash.; Pacific Area.

COL. W. A. CAPRON, Charlotte, N. C.; commanding officer, Ogden Arsenal, Utah.

COL. HAROLD J. CONWAY, Washington, D. C.; commanding officer, Ninth Service Command, Fort Douglas, Utah.

COL. RICHARD Z. CRANE, Grosse Pointe, Mich.; Frankford Arsenal, Pa.

COL. MERLE H. DAVIS, Burlington, Vt.; commanding officer, Rochester Ordnance District.

COL. HIRAM B. ELY, Flemington, N. J.; War. Department General Staff.

COL. VICTOR T. FAHRINGER, Arlington, Va.; Industrial Service, Office of the Chief of Ordnance.

COL. SAMUEL GORDON GREEN, Alexandria, Va.; Industrial Service, Office of the Chief of Ordnance.

COL. JAMES L. GUION, Kansas City, Mo.; chief, Military Plans Division, Office of the Chief of Ordnance.

COL. EARL C. GUISINGER, Gibsonburg, Ohio; chief, Office Service Division, Office of the Chief of Ordnance.

COL. REIFF H. HANNUM, Pottsville, Pa.; commanding officer, San Antonio Arsenal, Tex.

COL. WALKER W. HOLLER, Washington, D. C.

COL. JOHN HULING, JR., Tab, Ind.; commanding officer, Navajo Ordnance Depot, Flagstaff, Ariz.

COL. ROBERT J. ICKS, Lansing, Mich.; Office, Chief of Ordnance—Detroit.

COL. ALFRED B. JOHNSON, Washington, D. C.; Provost Marshal General's Office.

COL. WILLIAM B. JOHNSON, Easley, S. C.

COL. CLARENCE E. JONES, Detroit, Mich.; commanding officer, Anniston Ordnance Depot, Ala.

COL. THOMAS J. KANE, Punxsutawney, Pa.; Ordnance Board, Aberdeen Proving Ground, Md.

COL. EDGAR H. KIBLER, JR., New Berry, S. C.; Field Service, Office of the Chief of Ordnance (Oak Leaf Cluster).

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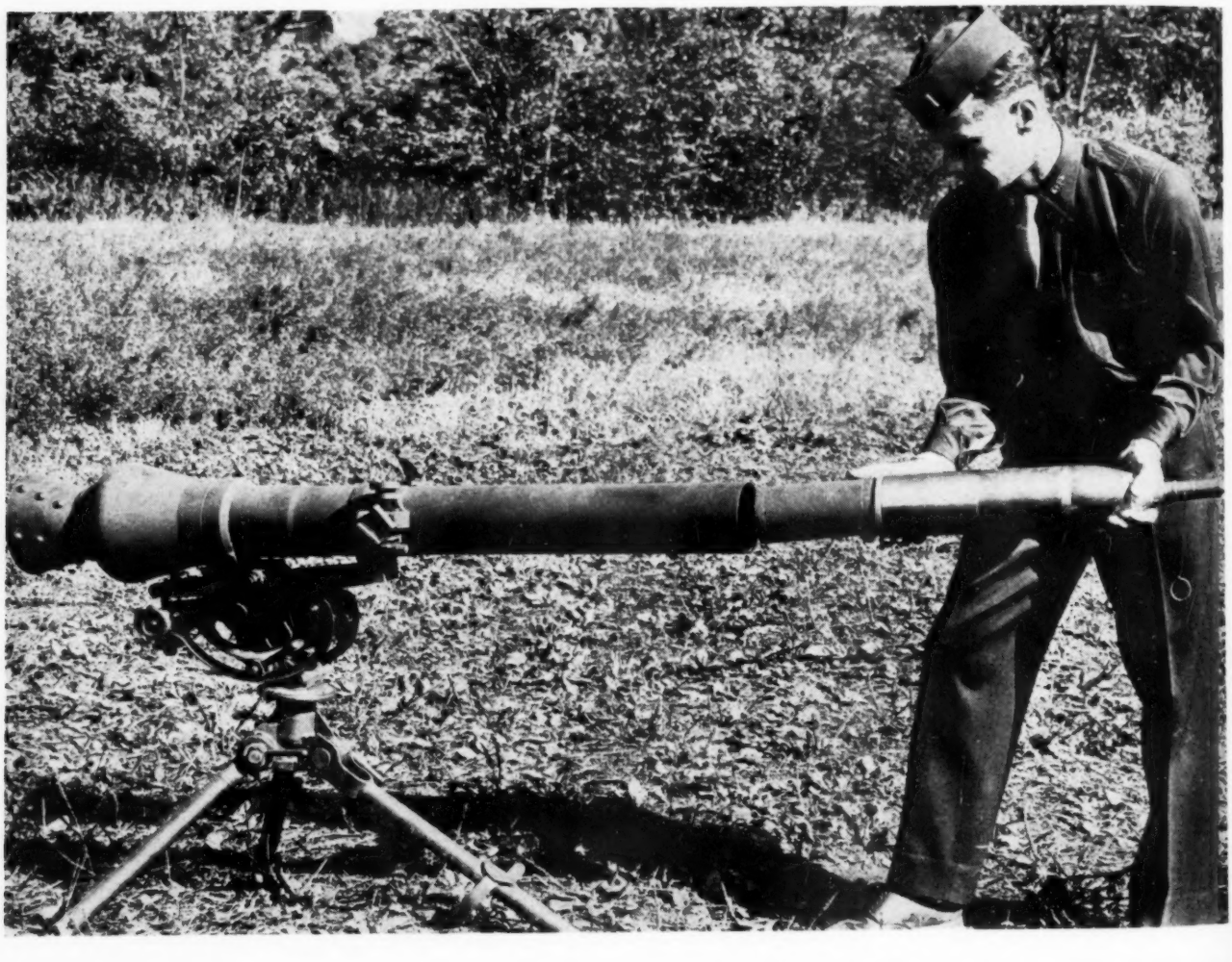
Lieut. Col. Rolf O. Wulfsberg, Massapequa, N. Y.

Maj. James F. Baldwin, Baltimore, Md.; Office of Foreign Liquidation Commission, Department of State.

Maj. Robert Elliott Benson, Sea Cliff, N. Y.; Control Division, Army Service Forces.

New Field Weapons for the Army

The 240-mm. howitzer motor carriage above is one of the newest weapons of the Army. The howitzer, shown in full recoil, has a range of approximately 25,000 yards, and the carriage has a speed of 25 m.p.h. on good terrain. The 4.2-inch recoilless mortar, below, weighs only 170 pounds. Its special 29-pound shell is fired at low angles by a driver rocket on the shell's nose.



Industry in the Confederacy

Shelby Iron Works Typified the Independent Manufactory

Southern ordnance production problems in the Civil War proved that no matter how much things change they are always the same.

by

Frank E. Vandiver

OF the many interesting facets of Confederate history, perhaps conditions behind the lines of battle are the most neglected. Charles W. Ramsdell in "Behind the Lines in the Southern Confederacy" ably pointed the way to a vast and virgin field of endeavor for southern historians. The people's relations with local, state, and central government authorities were of salient importance to the determined prosecution of the war. Ramsdell pictured the wave of eagerness that swept the Southland as the conflict opened and treated the gradual dimunition and final extinction of the people's "will to win."

Government may have rested lightly on the average individual in the Confederacy, but one group of citizens certainly was directly affected by Richmond's vagaries of fancy. This group was the unsung and patiently long suffering private manufacturer. Contrary to popular belief, industry was not nonexistent in the area comprising the Confederate States. Men of that region had become aware of the disproportionate division of the country's factories in the 'fifties, and vast strides had been made toward developing the South's manufacturing potential.

Mr. Vandiver is a young historian of the Confederacy. He is doing special research on the life of Brig. Gen. Josiah Gorgas, Confederate Chief of Ordnance.

Some industries were going concerns at the outbreak of hostilities. Others were in their infancy, and still more were to be organized by the stimulus of war.

If lack of markets for southern products had stunted industrial initiative to some extent before 1861, the industrialists of the South, after the capture of Fort Sumter, need fear no longer for lack of business. The sudden demand for arms, ammunition, clothing, and other war material afforded a market which the factories and machine shops of the seceding states could not begin to supply.

The War Department of the Confederacy, naturally enough, was the most voracious consumer of southern industrial products and hence the loudest caller for more. Since existing suppliers fell far short of surfeiting the War Department's need, the Government had to take a hand. The result of the adoption of this policy was a successful attempt on the part of the War Department to secure congressional assistance in this pressing problem. Congress, made to see the seriousness of the situation, offered substantial subsidies to individuals who would undertake the establishment of manufacturing plants to produce critical items.

Each department was wisely allowed to make and administer its own contracts with firms making materials which were particularly needed by the contracting agency.

The policy of decentralization went further. Each department granted contracting authority to its subordinate bureaus, reserving, of course, final approval to the head of the department. Thus it was with the War Department. The various supply bureaus proceeded to locate firms supplying needed items and contracted with them to furnish as much as could be obtained or as appropriations would permit.

Of all the services of supply under the Confederate Secretary of War, the Ordnance Bureau was perhaps the most effective. The absolute necessity of procuring the munitions for which Ordnance was responsible lent power to its activity. Necessity was not, however, the main factor leading to the over-all achievements of this corps. Careful, deliberate, and farsighted administration as well as profound logistical sense may be considered the main key to the Ordnance Bureau's accomplishments.

THE controlling brain of this bureau, Brig. Gen. Josiah Gorgas, was responsible for the able prosecution of ordnance business, and his knowledge of the importance of amicable understanding and harmonious relations between private contractors and the Ordnance Bureau was a great source of satisfaction to ordnance suppliers.

An example of the problems faced by an ordnance contractor is the case of the Shelby County Iron Manufacturing Company, near Columbiana, Ala. It is not the purpose here to give a detailed or complete history of the Shelby Iron Works, as it was known, but rather to illustrate, by citing it as a case in point, some of the obstacles faced generally by a private industry in the Confederacy.

The Shelby Iron Works had been tentatively organized before the war, and, as soon as possible after the formation of the Provisional Confederate Government in February 1861, the men in the company looked to the Government for financial encouragement. This was not long in coming. Gorgas was much in favor of getting the iron from the Shelby area and so was Comdr. George Minor, Chief of the Bureau of Ordnance and Hydrography of the Confederate States Navy.

These two, through the agent for ordnance at Selma, Ala.—Colin J. McRae—contacted the founders of the Shelby corporation with a view to concluding a contract. After settling points of importance to both parties, the company and the Government signed the agreement in April 1862.

The contract provided for the manufacture of 12,000 tons of iron a year for the Confederacy—or the total output of the works. In return for this the Government was to pay fair and even lib-

eral prices for the different types of iron and to advance $75,000 to get the company going. In addition, the Ordnance Bureau was to assist the company in obtaining the skilled workers needed and to furnish priority on necessary parts and equipment.

Financial solvency of the company was grounded on two security bonds—one for $100,000 and the other for $50,000, which were to back the Government's advance.

The company encountered troubles at the very outset. The first major one—and one whose repercussions were long felt both by the company and the Ordnance Bureau—was a somewhat obnoxious clause in the contract between the two parties. The company, since it was composed of men of experience and sound business sense, sought to indemnify itself against loss incident to the possible depreciation of Confederate currency by deleting a provision in the contract that the Government should pay, in current funds, its account with the company.

Preferably the Government should not stipulate how its bills with the Shelby concern were to be paid, but let the company secure payment in the most marketable securities of the time.

This attitude of the stockholders incensed Gorgas. He felt it indicated a lack of patriotism and a definitely mercenary viewpoint. A. T. Jones, president of the iron works, was adamant about changing the stand of the works on this issue, but, after haggling with McRae, he proposed to Gorgas that if the Government would delete the statement requiring payment of one-third of the total account in eight per cent Confederate bonds, he would drop the point of indemnification.

This problem was not settled quite to the satisfaction of either side, but the Shelby Company went on to execute the provisions of the contract regarding the production of iron. This was not easy for the company was working on a peculiar basis. All their iron was to go to the Government but not all to one place. Atlanta Arsenal, Macon Arsenal, Selma Foundry, the Army or the Navy—in fact all concerns working for or connected with the Government—could requisition them for iron.

McRae actually had the authority to order iron from the Shelby Works and, until he forwarded an order to Columbiana, it could not be filled. He was variously applied to by a Confederate agent needing iron for the manufacture of telegraph wire; by salt processors, for boiling kettles; by engine works, for machine iron; by the commander of Mobile's defenses, for iron to build a floating battery; by Dickson, Nelson & Company, Rome, Ga., for iron to make guns under contract with the State of Alabama. And all the time he was feverishly requesting metal for the ironclad-gunboats building at Yazoo City, Miss. If the requests were made by Government plants, as most of them were, they had to be filled if at all possible. At times, as in the case of Dickson, Nelson & Company, states' rights plagued the iron works.

"Brig. Gen. Josiah Gorgas, Confederate Chief of Ordnance, was responsible for the able prosecution of Ordnance business, and his knowledge of the importance of amicable understanding and harmonious relations between private contractors and the Ordnance Bureau was a great source of satisfaction to ordnance suppliers."

Then, of course, there were the emergency rush orders of iron for some special job—such as the floating batteries or the ironclads. Railroads, too, badly in need of railroad iron, importuned Shelby Company for as much as could be had.

All of these myriad demands and requests seemingly would have been ample to paralyze the company, but these were only additional worries. The company's real headaches were ones of supply. In their own small way they were encountering the problems of the Confederate Army. First and foremost was the conscription-induced shortage of skilled and unskilled labor with which to operate the works. The Conscript Bureau was omniverous and appeared to be everywhere. No one was safe away from the works. If an employee went to his home a few miles from the plant and neglected to get a permit, he would probably be enrolled.

Worse yet, most of the good mechanics were already in the army, and, once in, it was difficult indeed to secure their detail, though the company always tried to get good men from the army. In this attempt, at least, they were aided by the draft-harried Gorgas, who constantly pleaded the need for able workers to the Secretary of War.

But conscription alone was not the only concern of the iron works. Slave labor could be used to do the unskilled jobs around the plant. In securing slave workers, Shelby seems to have fared better than most other manufactories in the South, though Shelby always wanted more than they had. The company, in 1862, was hiring good Negroes at $125.00 a year.

The contract problem caused Jones and the stockholders to suggest changes several times. In their dealing with the Government on questions of this sort they invariably found Gorgas a firm businessman, eminently fair. In return he found himself dealing with able and independent men, determined to remain so and equally determined to carry out their contract to the best advantage. Gorgas must have realized he was fortunate to have the Shelby Iron Works as a contractor because of this attitude.

AS a result of the necessity of relying on the contract system of supplying ordnance stores in the early part of the war, he had seen concern after concern default on their contracts and had been forced to take them over and operate them with Ordnance personnel.

This had been true of the Spiller and Burr Pistol Factory in Atlanta, Ga., and with T. E. McNeill, who had enthusiastically contracted to make rifles in Macon. Cook and Brother, rifle manufacturers, Athens, Ga., collapsed and went into Confederate hands, and the Government bought the Tallassee gun factory, Tallassee, Ala.

On the brighter side of the picture were such firms as the Shelby Iron Company, Tredegar Iron Works, and Griswold and Gunnison, pistol manufacturers, who were able to meet and overcome the heartbreaking problems facing them and, at the same time, stay independent. This small group of hard-working, trouble-ridden, but determined, private industries was surely one of the outstanding products of Confederate society.

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JULY-AUGUST, 1946

Month by Month

New Name for an Old School.—At long last a misleading label is to be discarded. Hereafter the Industrial College of the Armed Forces will be the name of the erstwhile Army Industrial College. This move is in step with the times. Too many of our national-defense agencies labor under names and titles which are no longer explanatory of their function and purpose. Indeed, this magazine itself in its own given name is guilty!

The Army Industrial College, which has trained officers to cope with problems of wartime procurement and industrial mobilization since 1924, will be known henceforth as the Industrial College of the Armed Forces. The change of name recognizes the increasing participation of the Navy in the activities of the institution. It was recommended by a joint board appointed by the Secretary of War and the Secretary of the Navy, with John M. Hancock of New York, industrial banker, as president, to study postwar Army and Navy training in industrial mobilization. Commander Hancock writes on an allied subject in this issue (p. 36).

Other recommendations made by the board include establishing the Industrial College on the same level as the Army and Navy Staff College, now National War College, and the maintenance of close contact with the Army and Navy Munitions Board, the Planning Division of the Office of the Under Secretary of War, and similar agencies in the Navy and Air Force.

Members of the board, in addition to Mr. Hancock, were Messrs. Ormond E. Hunt, vice-president, General Motors Corporation; Joseph W. Powell, Sr., special assistant to the Secretary of Navy during the war and retired shipbuilder; and Lionel J. Noah, wartime civilian consultant to the Secretary of Navy, as civilian members; Maj. Gen. E. M. Powers and Brig. Gens. Hugh C. Minton and Gordon E. Textor, representing the Army; Vice Adm. William S. Farber, and Rear Adms. William J. Carter and Lewis L. Strauss, representing the Navy. Brig. Gen. Donald Armstrong, U.S.A., was recorder of the board.

General Armstrong, present commandant, has been designated to continue as commandant of the Industrial College of the Armed Forces, with Capt. E. R. Henning, U.S.N., and Col. Robert W. Brown, U.S.A., as assistant commandants.

Approximately ninety Army and Navy officers with World War II experience in procurement and industrial mobilization are currently studying at the Industrial College classrooms in the Pentagon Building. The next course will begin September 3, 1946, and will continue for ten months.

Organized Research and Development.—Another step toward a united policy of research and development for the national defense was taken early in May when the War Department announced the creation of a Research and Development Division as part of the General Staff organization to coördinate Army research with the activities of industry and educational institutions. There is far too much haphazard research and development activity within the Army.

Pretty soon now, the dollars-and-cents phase of research and development must come to the fore. Every penny spent for this most important work must be scrutinized most carefully—and we can ill afford to squander a penny. Indeed the time has come when the fighting men in our Army must stick to their knitting as fighting men, and allow the engineers and technicians to stick to theirs.

One of our great difficulties in World War II was the increasing encroachment of the fighting services upon the technologists. Because we have ground forces as a separate entity, it has been argued, the ground forces should engage in research and development of their particular matériel. The same has been proposed for the air forces and for the other combat units of our Army.

The result has been confusion worse confounded and an expenditure from the public purse of funds at a rate which our normal peacetime economy cannot well afford. It is to be hoped that one of the first lessons learned from World War II to be applied within the Army itself will be this: The fighting men will be trained to serve as fighting men; the scientists and technicians will be trained to do the research and development work in coöperation with private industry and our great educational institutions.

It is quite enough to be a good fighter and not try to be an engineer to boot. Too often our military leaders, expert in command and administration, assume also an expertness in technology which they do not possess. Being "Jacks-of-all-trades," frequently they are masters of none.

In a memorandum to all War Department organizations

outlining the Secretary of War's decision to create the new staff division, General of the Army Dwight D. Eisenhower, who has taken a personal interest in the project, stated that lessons learned in the war showed clearly the need for integration of all national resources in time of war. To this end, he stated, the Army "as one of the main agencies responsible for the defense of the Nation has the duty to take the initiative in promoting closer relations between civilian and military interests."

The division has primary interest in the application of national scientific resources to the solution of military problems. According to Dr. Edward L. Bowles, expert civilian consultant to the Secretary of War who aided General Eisenhower in developing the plan for the new division, the director will act as liaison between Army planning chiefs on one hand and industry and the universities and research laboratories on the other. Creation of the division will result in the Army's coördination with existing civilian organizations in the development of new military techniques.

In his directive General Eisenhower stated that "in order to ensure the full use of our national resources in case of emergency" the following general policies would be put into effect:

"1. The Army must have civilian assistance in military planning as well as for the production of weapons.

"2. Scientists and industrialists must be given the greatest possible freedom to carry out their research.

"3. The possibility of utilizing some of our industrial and technological resources as organic parts of our military structure in time of emergency should be carefully examined.

"4. Within the Army we must separate responsibility for research and development from the functions of procurement, purchase, storage, and distribution.

"5. Officers of all arms and services must become fully aware of the advantages which the Army can derive from the close integration of civilian talent with military plans and developments."

The director of the division will advise the Secretary of War and Chief of Staff on all research and development matters and will be responsible for the initiation, allocation, coördination, and progress of research and development programs. He is also charged with demonstration of new or improved weapons, military equipment, and techniques to the Army services which would use them. As a General Staff member, he will issue orders in the name of the Secretary of War and Chief of Staff on matters with which he is concerned.

All War Department activities dealing with research and development will come under this division.

General Barnes Retires.—Ordnance research and development lost one of its outstanding engineers when Maj. Gen. G. M. Barnes retired from active service last month. Under General Barnes' direction practically every weapon used by the Army was either developed, redesigned, or improved. He had the entire responsibility for the design, development, and standardization of 1,600 of the 1,800 major ordnance items employed by our armies against Germany and Japan.

Many of the new types were developed before they were needed, thereby avoiding long and costly delays in delivery to the battle zones. Experiments based on experience and keen analysis of military trends resulted in new lightweight weapons being developed in anticipation of our jungle and island warfare against the Japs. The concrete-piercing fuze was ready before our troops hit the Siegfried Line guarding the western approaches to Germany.

Before the end of the war, General Barnes was laying the foundation for a comprehensive plan of research and development for the Ordnance Department. He decided to continue to use the best brains of industry and science that had done such a remarkable job during the war. Today, twenty-five colleges, universities, and scientific organizations are carrying out research programs for the Ordnance Department. Where necessary, funds have been supplied to allow them to expand their laboratories and to purchase special equipment. In addition, more than 600 industrial firms are working on Ordnance problems. These firms range from industrial giants with multimillion-dollar research centers to firms employing only six employees.

"To keep this country strong and safe," General Barnes stated, "we must utilize the best resources in the world, which are our scientists and industrialists. By decentralization we have the entire country working for us instead of just a few hand-picked scientists at arsenals and proving grounds."

General Barnes was graduated from the University of Michigan with a degree in civil engineering in 1910. He entered the Army as a second lieutenant and transferred to the Ordnance Department in 1919. He has been extremely active in ordnance design and has been granted some thirty-four patents for inventions in the field of engineering. Some of these were so important basically that the Germans "adopted" some of them, it was found in studies of captured weapons.

After serving thirty-five years in the Army, General Barnes is retiring to take a position as engineering assistant to the president of the Edward G. Budd Company, Philadelphia, Pa., manufacturers of streamlined trains and automobile bodies and chassis.

Postwar Army.—Reiterating and emphasizing its policy laid down in 1944 that the United States military organization should be based on a relatively small professional establishment to be reënforced in emergency by organized units drawn from a citizen Army Reserve, the War Department has promulgated a new statement of "general principles governing preparation of postwar plans."

The circular (No. 119) directs that all officers familiarize themselves with the complete text of Section III of War Department Circular 347, 1944, in which the statement of policy was originally laid down.

The new circular states that the starting line for future plans is the conclusion that "Any war commencing within the next few years would of necessity initially be fought primarily with weapons and equipment now on hand or in production." With this realistic basis immediate plans for organization and training will be grounded on the weapons and equipment now on hand or in production at home and abroad.

However, personnel are cautioned to be ever alert to counter new measures and to take every advantage of new developments as they become available.

Hemisphere Security

An Editorial

ONE of the most far-reaching and most constructive steps toward the security of the Western Hemisphere is embodied in the plan presented to the Congress for the tactical and technical training of military and naval forces in coöperation with the governments of South, Central, and North America, including Canada. As proposed, military and naval equipment will be furnished to these governments from our tremendous surpluses, and steps will be taken to standardize the organization, tactics, matériel, and technique of the United States forces with those of our neighbors.

¶ In addition, the plan would permit furnishing our cadres to tactical organizations, opening our service schools to military and naval personnel, and otherwise assisting in the organization, training, and formulation of doctrines of the armed forces of our neighbors of the Americas. The legislation as presented to the Congress by the President is entitled "The Inter-American Military Coöperation Act."

¶ In specific terms, its purpose is to permit the Army and Navy, acting in conjunction with the Department of State "to continue in the future a general program of collaboration with the armed forces of our sister republics with a view to facilitating the adoption of similar technical standards. Certain additional training activities, not covered by existing legislation, would be permitted. The President would also be authorized to transfer military and naval equipment to the governments of other American states by sale or other method. The collaboration authorized by the bill could be extended also to Canada, whose coöperation with the United States in matters affecting her common defense is of particular importance."

¶ Here is the first major step toward a comprehensive military policy for the United States based on hemisphere security. It has immediate and long-range advantages. Among the former is the utilization of skills and machines which are now available in profusion. We have trained officers and men whose talents can be used to no greater purpose than to coöperate with the armed forces of our neighboring countries for the modernization and standardization of our individual and combined power.

¶ In addition, we in the United States have vast quantities of superior weapons bought at terrific price in effort and money which are available, preferably by donation, to our sister republics. Much of this superior matériel is surplus so far as the needs of our Army, Navy, and Air Force are concerned. No finer use of it could be made than to give it to the countries which comprise the Western Hemisphere and, having given it, assist those countries in every possible way by training and maneuver to utilize our American ordnance for their own security and that of the Western Hemisphere.

¶ More and more in the light of postwar developments the need for hemisphere security becomes the first consideration in the grand strategy for keeping war out of America. War must also be kept out of the Western Hemisphere. The soundness of this strategy has not been questioned seriously since the days of President Monroe. It is to be hoped that the country will approve unanimously the President's plan for hemisphere security for it is basic in the doctrine of national defense as applied to our own country and to the other countries which comprise the Western Hemisphere. Our security in the days to come rests not on Europe or Asia but upon the solidarity and strength of ourselves and our American neighbors.

Association Affairs

NEW CONSTITUTION FOR A.O.A.: Members' Approval Broadens Society's Scope

The new constitution and by-laws of the Army Ordnance Association, as published in full in the March-April 1946 issue of ARMY ORDNANCE, were overwhelmingly approved by the members of the Association. Indeed comments on the Gidney report, of which the new constitution and by-laws are a part, was unanimously favorable, and there were many expressions of thanks to Colonel Gidney and his associates for their splendid work.

The first step under the new constitution will be the election of the Council. The president of each local Post has been requested to designate a representative of the Post to serve as a member of Council. These representatives in turn will elect fifteen members at large. In addition, the charter national officers will be members of Council. It is planned that the Council will hold its first meeting as a feature of the Twenty-eighth Annual Meeting of the Association to be held next October. The Council's function will be to elect a board of directors which in turn will elect the officers of the Association for terms beginning January 1, 1947.

Present plans are to hold the Twenty-eighth Annual Meeting of the Association over a period of two days. The first day will be devoted to conferences, seminars, and meetings of the national activities Divisions which will be followed by a dinner that evening. These sessions will be held in Washington. The following day all members are invited to Aberdeen Proving Ground, Md., to witness current tests of Ordnance equipment at the invitation of the Chief of Ordnance, Maj. Gen. Everett S. Hughes, and the commanding general of the proving ground, Brig. Gen. A. B. Quinton, Jr. The dates of the meeting and complete details will be announced in due course, and personal invitations will be sent to all members.

ASSOCIATION ASSISTS ORDNANCE: Plans Research and Development Survey

The Army Ordnance Association will undertake a series of studies and recommendations at the request of Maj. Gen. Everett S. Hughes, Chief of Ordnance. He has requested that the Association advise the Ordnance Department on steps to be taken in a number of important fields, including research and development, the future plans and policies governing the Ordnance district system, and a program of Ordnance training—military and civilian.

These questions were discussed at a special meeting of the executive committee of the Association held in New York, April 25, 1946, and the following resolutions were adopted:

(1) That the Army Ordnance Association organize immediately a Research and Development Division under the chairmanship of an outstanding scientist with an executive committee of equally prominent physicists, chemists, and engineers. This committee and the Division will be purely advisory as are all other committees and Divisions of the Association. To this committee will be referred the problem of choosing an outstanding scientist to serve in the liaison capacity suggested by General Hughes, the recommendation of the committee to be subject to the approval of the Association's executive committee.

(2) That a special committee be appointed to study and report, with recommendations, on the scope and functions of the Ordnance district system in time of peace, with the understanding that the Chief of Ordnance will make available to such committee the necessary factual materials upon which to base its conclusions, and that the views and opinions of former district chiefs be given full consideration. The following members will be requested to serve on this committee:

Frank B. Bell, Pittsburgh, chairman; John Slezak, Chicago; Dean Witter, San Francisco; C. Jared Ingersoll, Philadelphia; Russell E. Gardner, Jr., St. Louis; Lynn Pearson, Cleveland; and Whitney Stone, New York.

(3) That a special committee be appointed to study and report upon the scope and form of the Ordnance training system in time of peace, with the understanding that the Chief of Ordnance make available such factual material and source references as may be necessary. The chairman, with the approval of the committee, announced that the following members will be requested to serve on this committee:

Alex R. Stevenson, General Electric Company, Schenectady, N. Y.; John E. Johnson, General Motors Corporation, Detroit, Mich.; Roy W. Utley, Chrysler Corporation, Detroit, Mich.; Dean Ivan C. Crawford, University of Michigan, Ann Arbor, Mich.; Dr. Robert E. Dougherty, Carnegie Institute, Pittsburgh, Pa.; and Dr. A. C. Willard, University of Illinois, Urbana, Ill.

The executive committee also discussed the establishment of a medal to bear the name of Brig. Gen. Benedict Crowell, president of the Association, 1919-1946, to be awarded for outstanding service to the Army Ordnance Association in bringing its work to the attention of the general public. The Crowell Medal will be awarded for the first time at the annual meeting of the Association to be held in the fall of 1946.

With the approval of the committee the chairman announced the appointment of the Committee on Awards for the year 1946. This committee will recommend candidates to receive the Crowell, Crozier, Scott, and Rice Medals. The following members will be requested to serve on the committee:

Charles McKnight, Morristown, N. J.; Allen Rushton, Birmingham, Ala.; and J. E. Kanaley, Davenport, Iowa. Their report is to be submitted not later than July 1, 1946.

GOLD MEDAL: Philadelphia Post Honors Du Pont President

Walter S. Carpenter, Jr., president of E. I. Du Pont de Nemours & Company, was the recipient of the John C. Jones Ordnance Gold Medal for 1945 awarded annually for "distinguished service to Ordnance" by the Philadelphia Post, Army Ordnance Association. The presentation was made April 26, 1946, at the headquarters of the Philadelphia Ordnance District by C. Jared Ingersoll, president of the Post and former chief of the Philadelphia Ordnance District. Maj. Gen. G. M. Barnes, Assistant Chief of Ordnance, was the principal speaker.

This is the second award of the Jones Medal. The first, presented in 1945, was made to Lieut. Gen. Levin H. Campbell, Jr., wartime Chief of Ordnance. In presenting the award, Mr. Ingersoll cited the outstanding career of Mr. Carpenter in its relation to the national defense of the United States. In making the presentation Mr. Ingersoll said:

"It is perhaps significant, in light of the Du Pont contributions to Ordnance, that Mr. Carpenter's early training was received in the development department. His appreciation of the importance of intensive and continued research has unquestion-

ably guided his company's policy. Mr. Carpenter was elected president and chairman of the executive committee of E. I. Du Pont de Nemours & Company on May 20, 1940, at the very time when the battles of the Lowlands and of France were prompting Congress to multiply Ordnance appropriations. Ordnance needs were many, but fortunately the Du Pont Company, through its peacetime research, was prepared to offer the formulas and manufacturing methods required for many of these needed items. Unhesitatingly, and without thought of profit, the entire resources of the company were offered to the Government.

"This same policy of unswerving patriotic service has been constantly maintained—no assignment too difficult, no sacrifice too great. Mr. Carpenter, as chief executive of the company, must accept credit for the formulation and steadfast maintenance of this policy."

NEW YORK POST: General Hughes Honored at First Postwar Meeting

The first postwar meeting of the New York Post of the Association was held at the Pennsylvania Hotel in New York on April 26, 1946, with Maj. Gen. Everett S. Hughes, acting Chief of Ordnance, as the guest of honor. An unusually large delegation of members representing American industry and the armed forces in and about New York was present to do honor to General Hughes. R. E. Gillmor, retiring president of the Post, presided at the meeting and introduced the guest speaker.

At the conclusion of the meeting, H. M. Tillinghast, recently elected president of the Post, assumed office and announced plans for a number of activities to be sponsored by the Post in the coming year.

General Hughes, in his address, emphasized the important relationship existing between the Army Ordnance Association and the Ordnance Department. He outlined his policies looking toward a closer utilization of the skills and counsel of members of the Association in the solution of Ordnance problems, particularly in the fields of research and development. He suggested close liaison on the part of the national activities Divisions of the Association with the opposite numbers in the Ordnance Department organization. These matters were acted upon at the special meeting of the executive committee of the Association already described.

The other Post officials elected, in addition to Mr. Tillinghast, are: 1st vice-president, C. S. Comeaux; 2nd vice-president, J. E. McNary; 3rd vice-president, T. E. Murray; 4th vice-president, J. T. Mackey; treasurer, Crosby Field; secretary, B. R. Olmsted; executive committee: the officers and T. F. Brown, W. A. Davidson, R. E. Gillmor, C. J. Hardy, C. W. Keuffel, A. E. Van Cleve.

IMPORTANT CHANGES: Hartford-Springfield Post Announces New Officials

At a meeting of the board of directors of the Hartford-Springfield Post held at the Colony Club, Springfield, Mass., on April 29th, important changes among the governing body of the Post were announced. John S. Begley, former chief of the Springfield Ordnance District, resigned as secretary-treasurer and was succeeded by Lieut. Col. R. A. B. Heap. Brig. Gen. N. F. Ramsey, former commanding officer of the Springfield Armory, also submitted his resignation due to his retirement from active service and his change of residence to Maryland.

Col. S. H. MacGregor, commanding officer of the armory, and Col. James L. Hatcher, chief of the Springfield Ordnance District, were elected to membership on the board. E. B. Gallaher was appointed a member of the Council of the national Association representing the Hartford-Springfield Post in conformity with the new constitution of the Association.

Present at the meeting were Col. Frederick H. Payne, president; S. C. Hope, vice-president; Mr. Gallaher, vice-president; Colonels MacGregor, Hatcher, Heap, and Messrs. H. C. Beaver, W. M. Goss, Edwin Pugsley, and J. Y. Scott.

EMPIRE POST: Annual Dinner-Meeting Held in Syracuse

The annual meeting and dinner of the Empire Post was held in the ballroom of the Hotel Syracuse, Syracuse, N. Y., on the evening of April 30th, with over 400 members present. Guest speakers were Vice Adm. George F. Hussey, Jr., Chief of the Navy Bureau of Ordnance, and Col. Leo A. Codd, executive vice-president of the A.O.A.

Frank J. Smith, president of the Post, acted as master of ceremonies. Keith Williams of Buffalo, Post vice-president; Col. Merle H. Davis, secretary; and Col. "Jimmy" Walsh also had assignments on the program.

A feature of the program was the presentation of a distinctive plaque to each of the five living men who served either as chief or deputy chief of the Rochester Ordnance District from 1923 to 1945: Col. Ledyard Cogswell, Jr., Erwin R. Davenport, Col. Roy L. Bowlin, Col. Frank J. Atwood, and Col. Arthur J. Schamehorn. Decidedly the dean of this group was Colonel Cogswell of Albany, who served the District as civilian chief through the difficult and often discouraging years of the procurement planning period, from 1923 to 1940. Frank S. Noble of Rochester, who served as chief of the District at its inception in World War I, died in 1921. Distinctive awards were given also to the following large group of officers who served the district for two years or more in World War II:

1st Lieut. William J. Bertsche, Lieut. Col. Chester W. Bissell, Maj. James R. Bradburn, Capt. William F. Butler, Capt. Kendall B. Castle, Jr., Capt. Orval Clark, Capt. Eugene R. Clearman, Capt. Philip A. Conathan, Maj. Douglass C. Coupe, Capt. Peter W. Crump, Capt. Charles G. Daley, 1st Lieut. Clarence R. DeBow, Jr., Capt. Frank A. Eaton, Capt. Fred M. Emens, Lieut. Col. Thomas J. Evans, Maj. John S. Ewing, Capt. Laurence F. Fisher, Lieut. Col. Horace S. Ford, Jr., Capt. Albert C. Foss, Jr., Lieut. Col. John R. Fox, 1st Lieut. Mason C. Gaffney (deceased), Capt. Walter H. H. Haase, Col. Ronald C. Hands, Lieut. Col. Arthur O. Harris, Capt. John G. Hart, Capt. William L. Heindl, Capt. Alfred I. Hess, Lieut. Col. John F. Hotchkiss, Maj. Edwin D. Howell;

Maj. Edwin R. Kellogg, Capt. Lawrence B. Lavold, Lieut. Col. Fred B. Lehner, Maj. Stuart W. Lewis, Capt. Oliver R. Marshall, Capt. Thomas W. Meisenzahl, Capt. William C. Morin, Lieut. Col. Charles F. Mosher, Maj. Ralph E. Newcomb, Col. Ernest W. Ogram, Capt. Ralph H. Owens, 1st Lieut. Carleton C. Perry, Capt. Edward C. Polidor, Capt. William T. Price, Colonel Schamehorn, Maj. Walter R. Schlotzhauer, Maj. Victor A. Schroven, 1st Lieut. Craig E. Shouse, Capt. Robert G. Slick, 1st Lieut. Leslie N. Smoot, Lieut. Col. Paul Tanner, Capt. E. Gwyn Thomas, Capt. Gerald P. Troy;

Maj. Gustav E. Watters, 1st Lieut. William R. Wedler, Capt. Paul R. Wentworth, Capt. Ralston A. Weston, Capt. Raymond J. White, Jr., Maj. Howard N. Willoughby, Lieut. Col. F. Gordon Wright, Maj. Walter H. Wright, Capt. John G. Young, Capt. Richard G. Zens, Maj. John C. Zimmerman.

The Empire Post now boasts a little magazine—the *Bazooka*, which is mailed monthly to all Post members. Another activity of this Post is the current organization of nine practically autonomous chapters in the Post domain: Buffalo, Rochester, Syracuse, Utica, Capital Cities, Jamestown, Ithaca-Cortland, Tri-Cities, and Southern Tier. By means of these local chapters, the Empire Post plans to serve the rank and file of its membership, many of whom could not attend meetings half way across the State.

The following were also guests of honor:

Dr. Finla G. Crawford, vice-chancellor, Syracuse University; Carl F. Dietz, president, Manufacturers' Association of Syracuse; Edward A. Halbleib, first vice-president, Empire Post,

Army Ordnance Association; Capt. Henry T. Markland, U.S.N.; Rev. Charles C. Noble; Edward O'Hara, publisher, *Syracuse Herald-Journal;* and Ernest L. Owen, publisher, *Syracuse Post Standard;*

The following were in charge of the dinner: Mr. Dietz, chairman; Archie W. Bennett, H. F. Hodgkins, Howard Kane, Edward T. Murphy, Richard H. Pass, Norman M. Ross, Col. John S. Seybold, Fred B. Scott, E. L. Smith, Mr. Thomas, and Comdr. Ralph C. Walling.

SERVOMECHANISMS: Yankee Post Hears Dr. G. S. Brown

Dr. G. S. Brown, Massachusetts Institute of Technology, delivered a fascinating address on "Electronic Control" at the spring meeting of the Yankee Post, Army Ordnance Association, held at the Watertown Arsenal on the evening of May 14th. Servomechanisms and their relation to fire-control development were a special feature of Dr. Brown's discussion. This field of research and development holds great promise for Ordnance application, and the discussion which followed Dr. Brown's talk was indicative of the interest on the part of a large and enthusiastic audience.

H. E. Edwards, president of the Post, presided at a dinner which preceded the address and also introduced the speaker. Col. William B. Hardigg, commanding officer at Watertown, assisted by several senior officers of his staff, made the facilities of the arsenal available for this meeting. Colonel Hardigg, at the reception preceding the dinner, was joined by Col. W. R. Gerhardt, assistant commanding officer; Col. H. H. Zornig of the research staff; Col. L. J. Meyns, chief of the Boston Ordnance District, and the following officers of the Post: vice-presidents H. W. Bagnall and F. W. Knauth; directors H. S. Chafee, Ralph Gow, R. N. Greenwood, J. L. Martin, Richard Morse, C. S. Robinson, Joseph Spang, Jr., G. W. Sweet, and Thomas West.

Maj. George Paul Slade, secretary-treasurer of the Post, was in charge of the general arrangements. The meeting by its enthusiasm and popularity was indicative of the growing interest in Ordnance affairs in the Boston area under the leadership of the Yankee Post and its officials.

TEXAS POST: Directors Meet at Houston

A meeting of the board of directors of the Texas Post, Army Ordnance Association, was held May 11, 1946, in the conference room at C. Jim Stewart & Stevenson, Houston, Tex. The meeting was called to order at 2 p.m. by the president, Ross Stewart. Those present were: B. T. McNeil, Ralph Neuhaus, W. R. England, A. R. Engler, O. K. Black, and Maj. G. I. Calvert. Col. C. C. Chambers and George R. Brown were unable to be present.

The first item of business was the appointment of Major Calvert as secretary-treasurer for the current year. The next item of business was the appointment of a committee to audit the records and accounts of the treasurer for the past year. Mr. Engler was made chairman of this committee and directed to report his findings to the board at the next meeting. The secretary reported the proceedings of the last meeting which was held March 2, 1946.

A resolution was adopted by the Texas Post setting forth a 10-point program for the year 1946, and the secretary was instructed to advise national headquarters of the adoption of this resolution.

To carry out the program adopted, three committees were appointed with personnel as follows:

Program Committee.—L. B. Ryon, chairman; James Anderson, Herman Brien, L. A. Godbold, George O'Leary, and Joe R. Straus.

Public Relations Committee.—Lieut. A. T. Collins, chairman; Col. Oveta Culp Hobby, Lieut. Col. Marvin Hurley, Jim McGoodwin, G. A. Mabry, Ray Powers, and Hull Youngblood.

Membership Committee.—George R. Brown, chairman; Leo S. Bassett, Major Calvert, Hiram Clarke, Joe M. Kincaid, Jr., and representatives from the University of Texas, Texas A&M College, and Houston University.

OUTSTANDING SERVICE: Louis Polk Awarded Certificate of Appreciation

A certificate of appreciation has been presented to Louis Polk, president of the Sheffield Corporation, Dayton, Ohio, by Col. C. H. Deitrick, chief, Cincinnati Ordnance District, representing the Secretary of War. The award was for "outstanding service rendered to the Ordnance Department in time of war." In expressing his appreciation, Mr. Polk said he accepted it on behalf of his fellow workers as a symbol of their efforts in meeting the country's wartime needs.

The certificate was signed by Robert P. Patterson, Secretary of War; Lieut. Gen. L. H. Campbell, Jr., wartime Chief of Ordnance; and Gen. Brehon B. Somervell, formerly commanding general, Army Service Forces.

GUIDED MISSILES: Col. V. A. Stace Addresses Michigan Post Meeting

A special dinner-meeting of the Michigan Post was held in the auditorium of the Oldsmobile engineering building, Lansing, Mich., on May 20, 1946. Lieut. Col. V. A. Stace, who was in command of the Guided Missiles Branch of the Army Air Forces during the late war, was the featured speaker. Nearly 500 members of the Post and their friends resident in and near Lansing were in attendance.

This was the first in a series of such meetings sponsored by the Association in Lansing, under the direction of C. S. Skinner, Oldsmobile Division, General Motors Corporation, who is also a member of the Artillery and Artillery Ammunition Division of the Association. Colonel Stace presented moving pictures, including a captured German color film of the launching of the V-2 rocket bomb. He also described many facts of interest and significance in the applications of these missiles in atomic warfare.

A program of entertainment also was presented. Several officials of the Michigan Post from Detroit were in attendance, including E. T. Gusheé, president; K. T. Keller and Walter F. Rockwell, directors; Henry W. Sullivan, assistant secretary-treasurer. Col. William E. House, chief of the Detroit Ordnance District, was also present.

NECROLOGY

William Carter Dickerman, director of the Army Ordnance Association and former chairman of the board of the American Locomotive Company, died April 25, 1946, at his home in New York City. A charter member of the Army Ordnance Association and a member of its board of directors for many years, he was a leading exponent of industrial preparedness and contributed in great measure to the mobilization of American industry in World War II and in the production of superior fighting equipment for our ground, air, and naval forces.

Mr. Dickerman had been active for fifty years in the railroad equipment field. He became president of the American Locomotive Company in 1929 and chairman of its board in 1940. At the end of World War II he resigned both assignments, continuing as a member of the executive committee of the board of directors.

A native of Bethlehem, Pa., student of the Penn Charter School, Philadelphia, and graduate of Lehigh University of which he was a member of the board of trustees, Mr. Dickerman joined the newly formed American Car and Foundry Company in 1889 and was its operating vice-president until his affiliation with American Locomotive Company. In World War I he was in charge of the A.C.F.'s war production activities.

Known for his great civic interest and allegiance to social welfare, he was a trustee of the Grand Central Art Galleries of New York, a member of the Metropolitan Museum of Art, American member of council at London in the Newcomen Society of England, member of the Royal Society of Arts, London, and of the Guild of Brackett Lecturers at Princeton University. In 1938 he was awarded the degree of doctor of engineering by Lehigh University, and in 1945 the degree of doctor of laws by Union College.

The Army Ordnance Association mourns the passing of a great industrial and humanitarian leader whose devotion to the national defense in peace and in war took concrete form in the production of superior weapons in the two greatest wars in which our country has been engaged. Victory in both came from superior weapons in the production of which William Carter Dickerman gave loyal and patriotic service.

Brig. Gen. Charles B. Wheeler, distinguished Ordnance officer, died in his eightieth year at the home of his daughter, Mrs. G. Seth Nichols, at Wayland, Mass., April 11, 1946.

General Wheeler was born in Mateson, Ill., May 3, 1865, the son of Christopher O. Wheeler and Mary J. Safford. He was graduated from the United States Military Academy at West Point in 1887. He entered the Ordnance Department, after serving in the Artillery, in 1890, and served through the grades at various arsenals and depots. In 1914 he was made a colonel and October 6, 1917, a brigadier general. He was in charge of the Ordnance depot at Manila, 1906-1907, and for nine years subsequently was commanding officer of the Watertown Arsenal.

Having served as Acting Chief of Ordnance in 1918 during the absence overseas of Maj. Gen. William Crozier, Chief of Ordnance, General Wheeler was appointed Chief Ordnance Officer of the American Expeditionary Forces in France. Here he became associated with Col. William H. Eaton, of Eaton, Crane & Pike Company. Upon his retirement from active military service September 3, 1919, he became associated with Colonel Eaton as vice-president in charge of manufacturing of the Eaton Paper Company.

As during his military career, so in his peacetime pursuits General Wheeler displayed a constant interest in civic and cultural affairs. He was president of the Community Fund of Pittsfield for three years during its early development. One of the two men decorated with the English Order of the Bath by the Prince of Wales aboard the cruiser RENOWN in New York harbor, General Wheeler three years later was awarded the Distinguished Service Medal. He also held the rank of Commander of the Legion of Honor of France.

ARMY ORDNANCE records the death of this distinguished military and civilian leader with profound sorrow. General Wheeler typified the intense devotion to duty which has been characteristic of the Ordnance service for nearly a century and a half, and in private industry he strove for the same high purpose that his fellow citizens might share the blessings of peace through industrial progress.

Col. Harold S. Wilkins, who retired two years ago from service in the Ordnance Department, died at his summer home, Southampton, Long Island, June 16, 1946. He had served as a Regular officer in the Department throughout the years following World War I and until his retirement in 1944. Colonel Wilkins contributed greatly to the success of the Ordnance program in World War II. He had served during the years of peace in the Baltimore Ordnance District, at the Augusta Arsenal, Augusta, Ga., and at Governors Island, N. Y.

At the time of his retirement he was chief inspector at the Picatinny Arsenal, Dover, N. J., where he had been stationed for five years. There he established an inspectors' school where 3,000 Ordnance inspectors were trained during the war. His last contribution to these pages was an article, "These Also Bring Victory," describing the Ordnance inspection training system as taught at Picatinny. This article was published in the May-June 1942 issue (Vol. XXII, No. 132, page 951).

Born in Wallingford, Conn., Colonel Wilkins was graduated from the Massachusetts Institute of Technology in 1907. He also studied at Harvard and Columbia Universities. Later he served as physics instructor at M.I.T. and Phillips Andover Academy. He entered the Army in 1917 as a first lieutenant. On many occasions he was of inestimable help to the Army Ordnance Association on technical and scientific problems. We here record our thanks for his tireless efforts and also for his outstanding service to the national defense of his country.

Maj. Edward Bowes, an active member of the Army Ordnance Association and famed radio personality, died at his home in Rumson, N. J., June 13, 1946. A champion rifle shot, Major Bowes began his military service in Battery D, Second Artillery, California National Guard in 1893. He served as an officer in World War I and maintained a lasting interest in the Officers' Reserve Corps.

At the height of his fame he was an honorary mayor of 67 cities, honorary fire chief of 57, honorary police chief of 51, honorary editor of 30 newspapers, and an honorary member of many clubs, chambers of commerce, and boards of trade. In addition, he was honorary governor, brigadier general, and lieutenant governor, respectively, in three States and honorary colonel in four.

On many occasions throughout his long and popular career in radio, Major Bowes voiced his concern for the national defense of the United States. His helpfulness in this important field will be greatly missed as will his cheery "All right, all right" that greeted the amateur artists who performed for many years on his nationwide radio program.

Dr. Ernest Berl, professor emeritus of the Carnegie Institute of Technology and internationally known authority on explosives and chemical warfare, died at his home in Pittsburgh, Pa., February 16, 1946.

Shortly after his coming to the United States in 1933, he took an active interest in Ordnance and chemical-warfare problems, having served as chief chemist for the Austro-Hungarian Government during World War I. Best known for his researches on synthetic petroleum products, he served as a consultant for the Tennessee Valley Authority, the Department of Agriculture, the Bureau of Ordnance of the Navy, and the Chemical Warfare Service. He was highly regarded among his Ordnance confreres as a gentleman, scientist, and research specialist.

NOTICE has also been received of the deaths of the following members of the Association: W. R. Allen, Cleveland, Ohio; R. H. Bartlett, Tulsa, Okla.; Arthur Bentley, Chicago, Ill.; J. F. Conroy, Jr., Elkton, Md.; W. E. Cook, Camden, N. J.; A. V. De Forest, Cambridge, Mass.; C. F. Dupee, Springfield, Mass.; W. H. McPherson, Hammond, Ind.; W. H. Mohl, Philadelphia, Pa.; E. J. W. Ragsdale, Philadelphia, Pa.; C. S. Robinson, Youngstown, Ohio; L. V. Sams, Denver, Colo.; C. C. Secrist, Chicago, Ill.; R. B. Snodgrass, Detroit, Mich.; Jack Steinharter, Cincinnati, Ohio; W. F. Tannhauser, Milwaukee, Wis.; F. D. Van Sicklen, San Francisco, Calif.; C. H. Ward, Philadelphia, Pa. To their relatives and friends, ARMY ORDNANCE, on behalf of the Association membership, extends condolences.

Let's look ourselves over

ARMY ORDNANCE *is privileged to begin in this issue the publication of a series of articles from the pen of E. B. Gallaher of Norwalk, Conn. Mr. Gallaher's articles will appear regularly in this place. Their general purpose is to keep the eyes of the executives and engineers of American industry who comprise the more than 45,000 readers of this magazine on the ball of industrial progress.*

The author is an experienced counselor, a capable analyst, and a succinct writer. He has very graciously donated to the Army Ordnance Association his services which have already established for him a reputation so great that his following among American businessmen rivals that of the well-known national business counsel services.

The editors of ARMY ORDNANCE *take this means of thanking publicly the author of this column. They are confident that as Mr. Gallaher's series of articles progress they will become acknowledged sources of information and advice which will contribute in outstanding measure to the strength of American industry—for better living in peace and for victory if atomic war approaches the ramparts we watch.*—THE EDITORS.

Are We Taking Advantage of New Developments?

E. B. Gallaher

It is a great privilege to have been asked by ARMY ORDNANCE magazine to address its readers, and I only hope that I may be able to hold your interest. I wish to say at the outset that the opinions expressed will be frank—possibly too frank to suit every one—but they will be made in good faith and with the sole purpose in mind of accomplishing some good for our country by creating discussion. Nor do I expect all my readers to agree with me—if they did, there would be little purpose in my writing.

It is difficult to maintain interest in ordnance when there is no war in immediate sight, but it is even more difficult to make people understand that our defense agencies cannot go out of business during periods of normal living.

There is no greater truth than that found in the old, worn-out statement: "In time of peace, prepare for war." But how can we prepare for war and at the same time reconvert our plants to a peacetime economy?

You can best help the Army Ordnance Department and the entire military and naval organization by bringing your own plant up to its highest possible efficiency; and, incidentally, you can help your own industry and yourselves most by doing the very same thing.

During the war, special jobs were assigned to the various manufacturers of the country, and they introduced new methods, new techniques, and new tools to perform these special jobs.

The question now arises—are we, as a nation, going to take advantage of these new developments or are we going back to prewar practice? In my many visits to plants all over the country I have been struck with the high efficiency of their wartime operations—the new developments introduced, the new techniques employed, and the great variety of new machines developed to speed production and cut down costs.

I have been just as forcefully impressed with the fact that many plants, when it comes to reconverting to their prewar lines, are going back to their prewar methods and are retooling and re-equipping to use methods which, in some cases, are twenty-five years behind the times. I have often questioned this practice and have called attention to the many war advances in method and technique, only to be told that they had never heard of them!

If a plant reconverts, using prewar methods, we may be sure that the management of that plant will be out of competition before they realize it, as others with more vision will do the same job at a fraction of the cost by employing the countless new advances which are at their disposal.

Every operation should be studied in the light of modern technique, with an eye to reducing costs and accelerating production, before we retool and reëquip.

Our armed forces will benefit in direct proportion to the amount of diversification of our war advances among our industrial plants. If we can double or treble the number of men who have the "know-how," we will be two or three times better off if and when we are called upon again to equip for another war. If this costly war technique is lost to us as a nation and not made use of, then we will find ourselves in the same position as we were in 1940.

How To Obtain Current Data.—Now how are we going to obtain up-to-date information that will be important to us? Well, there are many approaches—the technical magazines, the national exhibits, such as the National Metal Congress and Exposition and the Convention of the American Society of Tool Engineers—but, more important, there are your own purchasing department and your mail department.

Have you ever stopped to think that there are literally thousands of salesmen calling upon your buyers every day who bring with them new ideas and new developments in all fields of endeavor, and that your buyer is, in reality, screening out these new ideas for you?

If your buyer is highly intelligent, and if he is in close touch with the development branch of your business, he undoubtedly obtains a great deal of information for you regarding new machines, new processes, new materials, and new products which your development department can study and utilize.

If, however, your buyer is one of those so-called "hard-boiled" individuals who has his personal friends among your suppliers and who turns down most of his callers with the statement that "I am all set"—that he has been doing business with some favored supplier for twenty years and he does not want to make a change, then he has slammed your door in the face of much valuable information which you sorely need, especially at this critical period of development.

In any event, your buyer should be instructed to obtain information from all callers and to transmit it to your development department—unless you wish him to do the screening of new ideas for you, which seems improbable.

This brings me to the importance of insisting upon at least two sources of supply for every commodity which enters into your manufacturing process. There are two very good reasons for this which should not be overlooked: Strikes often tie up a sole source of supply, and heavy snows in winter often seriously delay shipments which are critical.

But even more important is the fact that where you allocate, say, fifty per cent of your business to each of two suppliers, there is at once created competition between them, and each one will be continually striving to obtain the major share of your business. If prices are the same, the only legitimate way for these suppliers to obtain preference is to give you personal service—to keep you up to date on all new improvements, on new methods and new techniques in their line. Surely you should be glad to give more of your business to the concern which shows an active interest in your affairs—so it works both ways.

Then there is the department which receives your mail and distributes it. Do you realize how much valuable material is thrown away because it looks like advertising matter?

Well, most of it *is* advertising matter and can be thrown away, but it contains much valuable information, especially regarding new items, new machines, new materials, and new sources of supply which might be extremely helpful to those who plan your business. And yet most of us allow a mail clerk to decide for us the value of this critically important information.

I have found that manufacturers who have developed highly some special operation in connection with their war activities and which they now can use to their advantage in their postwar work will often lack information on the latest technique for other jobs they have in hand. So it has been thought that ARMY ORDNANCE magazine could possibly act as a clearing house to obtain the information you require.

We cannot go into technical discussions in this column nor have we the knowledge necessary to answer the many questions which would arise, but we do invite you to send us a brief inquiry, stating what technical information you desire. We will gladly print the inquiry in the hope that some reader who has the information would write us—then we could put you in contact.

A Look into the Future.—For the past one hundred years, up to the commencement of World War II, labor's share in industry has remained stationary at forty per cent of the cost of production. A hundred years ago there was invested $550 per worker in plant and equipment. Today we have invested $7,000 per worker in plant and equipment, and the worker is earning 1,500 per cent more than he earned per hour 100 years ago!

In surveys which I have made I find that labor is now getting variously from fifty to sixty-five per cent of the cost of production, and, naturally, this condition cannot continue if our plants are to stay in business—it just isn't in the cards.

We are faced with two alternatives: Shall we raise our prices to bring the labor cost in balance, or shall we try to hold our prices down and make necessary adjustments so that we can get enough additional production out of each worker to cover our present higher costs?

This brings up a very serious economic question which presents real dangers whichever way we decide to handle the matter. If we raise prices now, we may, for the moment, be helping inflation. Yet in a short time, when the loose money in consumers' hands has been spent, we are apt to be confronted by buyers' strikes and find ourselves with a lot of high-priced goods on our hands and few customers. The redistribution of wealth is progressing much faster than most of us think.

In addition, the raising of prices would probably be based not alone on our additional labor costs but would be designed to cover our present inflated overhead which would, later on, plague us when the time arrives when we will be forced to reduce prices to remain in competition.

If, on the other hand, we decide to make use of all the latest up-to-the-minute techniques, new methods, and new machines which have come out of the war effort, we can undoubtedly reduce our costs, including labor cost, to such an extent that we can produce our goods at lower cost than was ever before possible. We would then be able to handle our pricing in such a manner that we could take advantage of higher prices during the few months that lie ahead, following the price market down when this period arrives and always be in competition.

In the next issue I will review the probable trend of events, and I will make a close analysis of current conditions in comparison with conditions prevailing after World War I—the similarity is striking and may be helpful in charting our course.

E. B. Gallaher

PROFESSIONAL DIGEST

POSTWAR R.O.T.C. POLICY

The War Department has announced approval of a postwar policy concerning the Reserve Officers' Training Corps which makes provision for military training in two divisions: the Junior R.O.T.C. at approximately the secondary-school educational level, and the Senior R.O.T.C. at the junior college and college level.

The program is the result of a 3-month study by the War Department, during which time a number of civilian educators and military authorities were consulted. Among recommendations adopted was one granting increased emoluments to Senior R.O.T.C. students to make the training more attractive.

The mission of the Junior R.O.T.C. will be to lay the foundation of intelligent citizenship and give the student basic military training which will benefit himself and the military service if he should become a member thereof. The Senior R.O.T.C. will carry the mission into the production of junior officers who have qualities and attributes essential to their continued development as officers of the Army of the United States.

Junior R.O.T.C. instruction will be given in military school units of high-school level and above, which do not grant college degrees, and at regular civilian high schools and may be given at certain essentially military institutes which do not confer college degrees but are designated as a separate category by the Secretary of War. The course will consist of three hours of formal instruction a week for three academic years of thirty-two weeks each. Students satisfactorily completing the course will be credited with the completion of the first year of the Senior R.O.T.C.

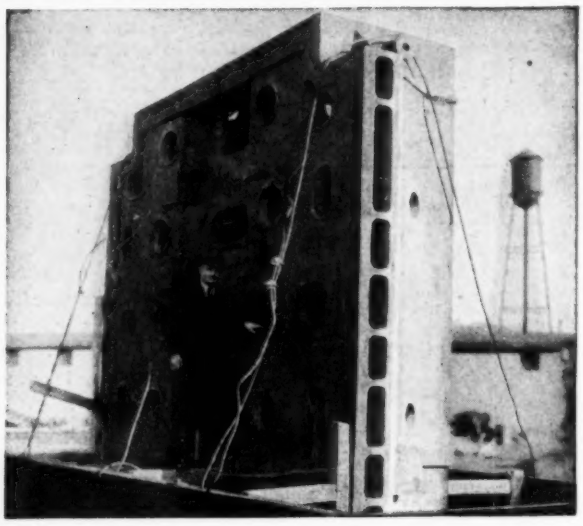
The Senior R.O.T.C. program, mostly conducted at the college level, will consist of two parts, known as the elementary course and the advanced course, the latter including a summer camp.

The elementary course will be a minimum of three hours a week for two academic years of thirty-two weeks each. It will be given at military institutes which offer college courses but do not grant college degrees, junior colleges, and civilian and military colleges and universities.

WHEREAS the Junior R.O.T.C. and the elementary course of the Senior R.O.T.C. will provide only general military training, the advanced Senior R.O.T.C. will be of a specialized-branch type, designed to qualify selected students for Reserve commissions in the several branches of the service, such as the Infantry, Field Artillery, and others. At present, there are no Air Force R.O.T.C. units, establishment of which will require legislative action. Summer camps will also be of a specialized-branch type.

The advanced course will consist of a minimum of five hours of formal instruction a week for two academic years of thirty-two weeks each. The summer camp period will be of eight weeks' duration instead of the present six, if legislation permitting the extension is enacted. The advanced course will be conducted only at civilian and military colleges and universities offering 4-year courses, or longer, leading to a degree.

Land-grant colleges which have required military training may continue this requirement with the War Department encouraging and assisting. However, all students will not necessarily be formally enrolled in the R.O.T.C. and eligible for its proposed emoluments unless they meet prescribed requirements.



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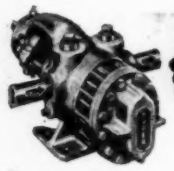
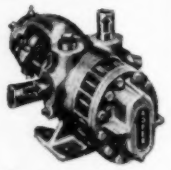
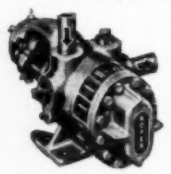


1. Horizontal inlet and discharge.



2. Horizontal inlet, vertical discharge.



3. Vertical inlet, horizontal discharge

4. Vertical inlet and discharge.

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Professional Digest

The War Department will seek passage of enabling legislation to grant emoluments to students in the elementary course of the Senior R.O.T.C. of 66 cents a day plus uniforms, and to increase the emoluments to students in the advanced course to 66 cents plus $1.25 a day. The advanced students would be required to buy their own uniforms.

Institutions desiring to provide a distinctive type of uniform or individually tailored uniforms for the Junior R.O.T.C. or the elementary Senior course may draw commutation in lieu of issuance of Government uniforms in an amount set by the Quartermaster. Students at R.O.T.C. summer camps will be furnished the necessary field-type uniforms.

MINIMUM requirements for a Reserve commission will include the successful completion of four years' education at the college level and the successful completion of the Senior R.O.T.C. course. The student also must have reached the age of 21 before he is granted a commission. For a commission as a first lieutenant in a professional branch, such as the Medical Corps, the candidate must have received his professional degree.

In case a student is specializing in a technical or scientific field, such as engineering or chemistry, at an institution which does not have that R.O.T.C. branch, he may be sent to a summer camp of the appropriate branch, such as the Corps of Engineers or Chemical Warfare Service camp, and obtain his commission in that branch within quota limitations.

The War Department also plans to negotiate with schools maintaining R.O.T.C. units to obtain academic credit for such training on the same basis as for nonmilitary subjects where such an agreement does not now exist.

Quotas for the Senior R.O.T.C. will be allotted annually by the War Department, and separate contracts will be executed by students admitted to the elementary and advanced Senior R.O.T.C. courses. No contracts will be executed for the Junior R.O.T.C.

Military instruction at each institution will be under the direction of the professor of military science and tactics appointed by the War Department. He will be assisted by other officers and noncommissioned officers of the Army. If authorized by legislation, the War Department will also negotiate with the individual institutions for the services of civilian instructors in the teaching of certain academic subjects related to the military.

The new program will go into effect with the start of the fall term of 1946 in so far as existing laws and appropriations will permit. The present interim R.O.T.C. program will be absorbed into the new program where practicable.

Intensive postwar training has already been started at Ordnance installations and 1,026 enlisted men will receive specialized technical training.

The Ordnance Department will train 695 R.O.T.C. graduates at 30 universities each year, and a series of Ordnance Extension Courses are being prepared at the Ordnance School, Aberdeen Proving Ground, Md.

Ordnancemen are also being sent to other technical schools such as the Quartermaster clerk's course at Camp Lee, Va., and the drafting courses at the Engineer School, Fort Belvoir, Va.

R.O.T.C. courses at thirteen prewar training schools have been established, and seventeen more universities will offer Ordnance courses. Only engineering students are accepted for Ordnance R.O.T.C. training. Massachusetts Institute of Technology, Cornell University, Lehigh University, Georgia Tech, The Citadel, Purdue University, University of Cincinnati, University of Michigan, University of Oklahoma, Texas A. & M., Leland Stanford University, University of California, and Louisiana State University are offering Ordnance R.O.T.C. training. Some universities are already offering interim courses, but the majority will open this fall.

YORK VAULT REMAINS INTACT

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When Yank troops reëntered Manila they found that the bombs, artillery shells, and fire which had razed the building housing the Bank of the Philippine Islands had no effect on the YORK VAULT which stood firm and unopened during more than two years of Japanese occupation and many bombardments. Pictured at right are a U. S. Army officer (left) and an official of the Bank who found the contents of the YORK VAULT intact after it had been opened by Army Engineers. Under most severe conditions, records and valuables necessary to the reëstablishment of the Bank were fully protected by this YORK VAULT installed in 1923.

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Ordnance Directory

A Record of Industrial Achievement—Part I

F. W. Foster Gleason

AFTER every major conflict the terminology of ordnance undergoes a vast expansion and its nomenclature acquires new meanings. So, too, many Ordnance establishments are founded, and older ones assume new importance.

The editors of ARMY ORDNANCE have for some time felt the need of a reasonably complete explanatory glossary, combining the ordnance items developed in World War II with the latest usages of older terms, as well as a directory of Ordnance establishments.

Therefore a directory and glossary will be published serially in ARMY ORDNANCE. First will come the list of Ordnance establishments extant at the time of Japan's surrender (August 14, 1945). This will be followed by the glossary of ordnance nomenclature.

Army Ordnance Establishments as of August 14, 1945

ABERDEEN PROVING GROUND—Aberdeen Proving Ground, Md. Proof of equipment and ammunition.

ABERDEEN ORDNANCE DEPOT—Aberdeen Proving Ground, Md. General supplies and ammunition storage.

AKRON REGIONAL OFFICE—First Central Tower, Akron, Ohio.

ALABAMA ORDNANCE WORKS—Sylacauga, Ala. Smokeless powder, DPA, DMA, tetryl, oleum, TNT, DNT, and sellite. *Operator:* E. I. Du Pont de Nemours & Co.

ALBANY REGIONAL OFFICE—15 Park St., Albany, N. Y.

AMMUNITION BRANCH, SMALL ARMS DIVISION—N. W. Ayer Building, Philadelphia, Pa.

ANNISTON ORDNANCE DEPOT—Anniston, Ala. Ammunition and general supplies storage. *Operator:* Anniston Warehouse Corp. (Chrysler Corp.).

ARKANSAS ORDNANCE PLANT—Little Rock, Ark. Loading plant, fuze, primers, percussion elements, detonators. *Operator:* Ford, Bacon & Davis, Inc.

ARTILLERY DEVELOPMENT SUBOFFICE—Franklin Institute, Philadelphia, Pa.

A. S. F. TRAINING CENTER (Ordnance)—Aberdeen Proving Ground, Md.

ATLANTA ORDNANCE DEPOT—Atlanta, Ga. General supplies.

AUGUSTA ARSENAL—Augusta, Ga. General supplies.

BADGER ORDNANCE WORKS—Baraboo, Wis. Smokeless powder, oleum, EC powder. *Operator:* Hercules Powder Co.

BALTIMORE REGIONAL OFFICE—26 W. Mount Royal Avenue, Baltimore, Md.

BAYTOWN ORDNANCE WORKS—Baytown, Tex. Toluol. *Operator:* Humble Oil & Refining Co.

BELLE MEADE ASF DEPOT, ORDNANCE SECTION—Belle Meade, N. J.

BENICIA ARSENAL—Benicia, Calif. General supplies and ammunition storage.

Mr. Gleason was formerly on the executive staff, historical section, Office of the Chief of Ordnance.

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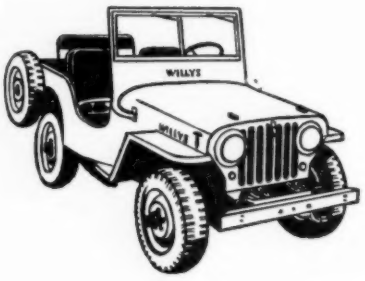
Portland, Oreg. Los Angeles, Calif.



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Ordnance Directory

BERWICK REGIONAL OFFICE—American Car & Foundry Co., Berwick, Pa.

BETHLEHEM REGIONAL OFFICE—Bethlehem Steel Corporation, Bethlehem, Pa.

BIRMINGHAM ORDNANCE DISTRICT—700 Frank Nelson Building, Birmingham, Ala.

BLACK HILLS ORDNANCE DEPOT—Igloo, S. Dak. Ammunition and general supply storage.

BLUEBONNET ORDNANCE PLANT—McGregor, Tex. Loading plant: Shells, bomb clusters, demolition blocks, bombs. *Operator:* National Gypsum Co.

BLUE GRASS ORDNANCE DEPOT—Richmond, Ky. Ammunition and general supplies storage. *Operator:* Blue Grass Ordnance Depot, Inc. (Firestone Tire & Rubber Co.).

BOSTON ORDNANCE DISTRICT—140 Federal Street, Boston, Mass.

BUCKEYE ORDNANCE WORKS—Ironton, Ohio. Anhydrous ammonia. *Operator:* Atmospheric Nitrogen Corp.

BUFFALO REGIONAL OFFICE—286 Main Street, Buffalo, N. Y.

CACTUS ORDNANCE WORKS—Dumas, Tex. C-S. *Operator:* Shell Union Oil Corp.

CANNON SUBOFFICE—Watervliet Arsenal, Watervliet, N. Y. (Artillery Division, Industrial Service).

CANTON REGIONAL OFFICE—Renkert Building, Canton, Ohio.

CARTERET ORDNANCE MOTOR RECEPTION PARK—Rahway, N. J.

CASAD ORDNANCE DEPOT—New Haven, Ind. General supplies.

CHATTANOOGA REGIONAL OFFICE—Chattanooga Bank Building, Chattanooga, Tenn.

CHEROKEE ORDNANCE WORKS—Danville, Pa. Formaldehyde, hexamine. *Operator:* Heyden Chemical Co.

CHESTER TANK DEPOT—Chester, Pa. *Contractor:* Ford Motor Co.

CHICAGO ORDNANCE DISTRICT—38 South Dearborn Street, Chicago, Ill.

CHICKASAW ORDNANCE WORKS—Millington, Tenn. TNT, DNT, and smokeless powder. *Operator:* E. I. Du Pont de Nemours & Co.

CINCINNATI ORDNANCE DISTRICT—Big Four Building, Cincinnati, Ohio.

CINCINNATI REGIONAL OFFICE—Big Four Building, Cincinnati, Ohio.

CLEVELAND ORDNANCE DISTRICT—Terminal Tower Building, Cleveland, Ohio.

CLEVELAND REGIONAL OFFICE— B. of L. E. Building, Cleveland, Ohio.

COLUMBUS ASF DEPOT, ORDNANCE SECTION—Columbus, Ohio. General storage.

COOSA RIVER ORDNANCE PLANT—Talladega, Ala. Bag and igniter loading, rockets. *Operator:* Brecon Loading Co.

CORNHUSKER ORDNANCE PLANT—Grand Island, Nebr. Bomb and shell loading. *Operator:* Quaker Oats Ordnance Corporation.

CURTIS BAY ORDNANCE DEPOT—Baltimore, Md. Ammunition storage.

DALLAS REGIONAL OFFICE—Liberty Bank Building, Dallas, Tex.

DAYTON REGIONAL OFFICE—Third National Building, Dayton, Ohio.

DELAWARE ORDNANCE DEPOT—Pedricktown, N. J. Ammunition storage.

DENVER ORDNANCE PLANT—Denver, Colo. Shell and fuzes.

DENVER REGIONAL OFFICE—Continental Oil Building, Denver, Colo.

DES MOINES ORDNANCE PLANT—Des Moines, Iowa. Small-arms ammunition. *Operator:* U. S. Rubber Co.

DETROIT ARSENAL (formerly Office, Chief of Ordnance—Detroit), Detroit, Mich.

DETROIT GAGE SUBOFFICE—Union Guardian Bldg., Detroit, Mich.

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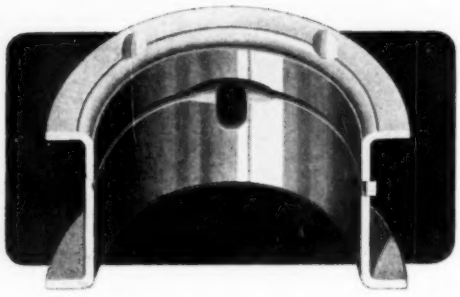

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Ordnance Directory

DETROIT ORDNANCE DISTRICT—National Bank Building, Detroit, Mich.

DICKSON GUN PLANT—Houston, Tex. Gun tube casting. *Operator:* Hughes Tool Co.

DIRECTOR OF PERSONNEL, OCO, SUBOFFICE—Philadelphia Ordnance District—150 South Broad Street, Philadelphia, Pa.

DIXIE ORDNANCE WORKS—Monroe, La. Anhydrous ammonia. *Operator:* Commercial Solvents Corporation.

EAST TENNESSEE ORDNANCE WORKS—Copperhill, Tenn. Oleum. *Operator:* Tennessee Copper Co.

EDGEWOOD ARSENAL ORDNANCE ASSEMBLY PLANT—Edgewood, Md. Chemical shell assembly.

ELWOOD ORDNANCE PLANT—Joliet, Ill. Loading plant: shells, bombs, boosters, primers, mines, demolition blocks, fuzes detonators. *Operator:* Sanderson & Porter.

ENGINEERING AND ADMINISTRATIVE SUBOFFICE—Union Guardian Building, Detroit, Mich. (Production Service Division, Industrial Service).

ERIE ORDNANCE DEPOT—Lacarne, Ohio. General supplies and artillery storage.

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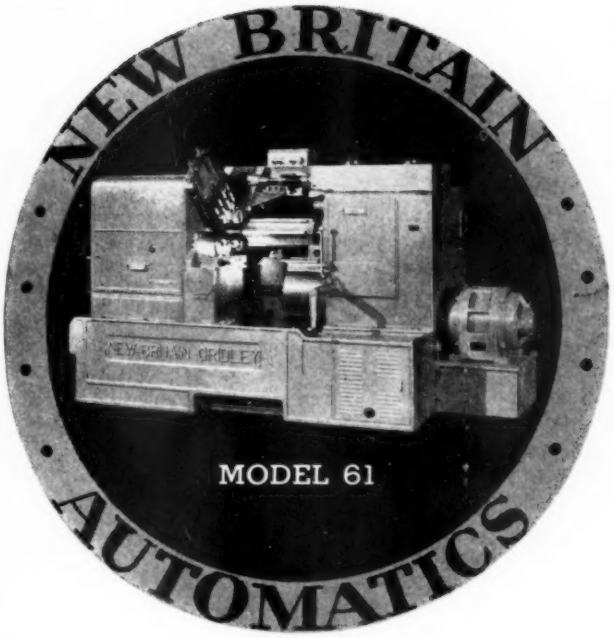

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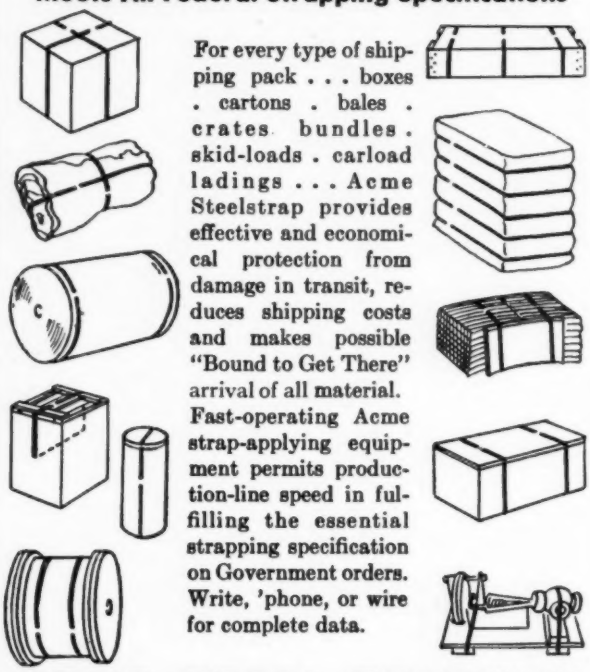

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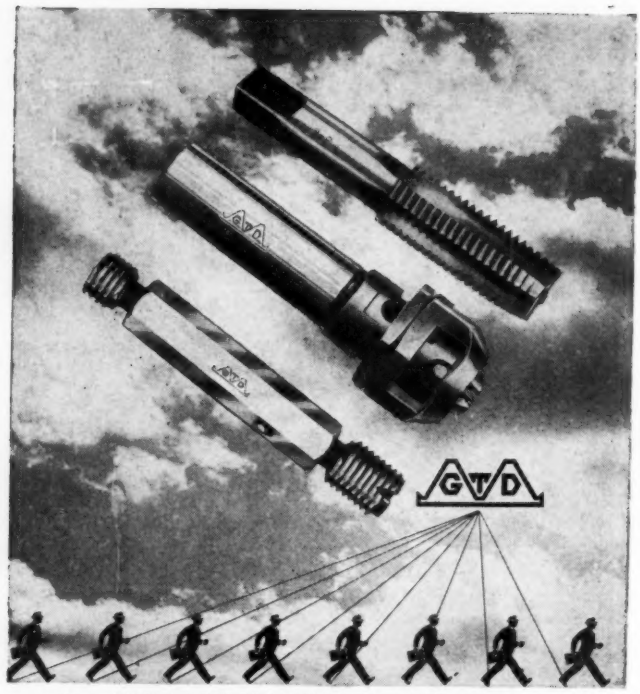

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F. W. FOSTER GLEASON, *military historian, ordnance analyst, editor, Washington, D. C.*

LIEUT. COL. CALVIN GODDARD, *small-arms authority, Washington, D. C.*

CAPT. MELVIN JOHNSON, *automatic arms expert, inventor, author, Boston, Mass.*

BRIG. GEN. R. H. SOMERS, *engineer, ballistician, author, editor, Dover, N. H.*

COL. THOMAS K. VINCENT, *artillerist, engineer, author, Springfield, Mass.*

COMMONSENSE SHOTGUN SHOOTING. By Fred Etchen. Huntington: Standard Publications, Inc. 186 pp. $6.

AFTER more than half a century behind a gun, Fred Etchen has yielded to the yen to do a book on shotgun shooting. His contribution, a very creditable one, is the latest of a long line—one practically coeval with the invention of movable type.

Whereas modern books on the shotgun and its use exhibit marked similarity in general content and treatment, early works on sporting gunnery are far from falling into a stereotyped pattern. They are as different in coverage and format as the individualities of their authors.

The tendency toward sameness in today's books on how to become proficient with the shotgun derives doubtless from the unhappy fact that there is much less to say about this subject than there once was. The types of game considered suitable for the bag of the accomplished sportsman, in the United States at least, have diminished so markedly; closed seasons, once nonexistent, are now so long; and bag limits, likewise once unknown, so reduced, that to keep his hand in the marksman must practice upon inanimate objects.

This calls for chapters on trapshooting, and that comparatively recent offshoot of the same, "skeet." It calls for more space devoted to the fit of guns, their handling and care, safety rules and their observance, and less to instructions on how to take game. In evidence whereof, Etchen offers a single, 7-page chapter on "Hunting and Locating Your Game."

Etchen's work is done in a most readable style and should appeal to every lover of the smoothbore. His opening remarks—eight pages of shooting reminiscences—will bring nostalgic memories to the old-timers and leave the modern shooter green with envy at the limitless opportunities for the taking of game which his forebears enjoyed and accepted as a matter of course. The remainder of the book is full of advice from master to pupil by which the latter can profit, and handsomely, if he will.—CALVIN GODDARD.

SOUTHERN HORIZONS. By William Haynes. New York: D. Van Nostrand Company. 316 pp. $2.75.

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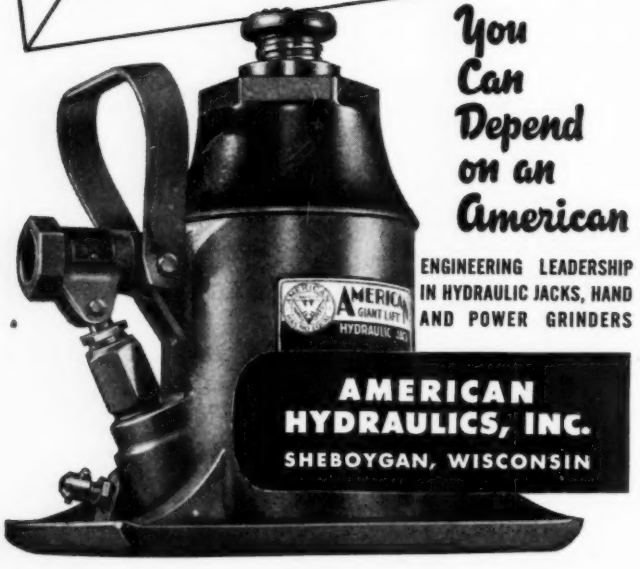

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Book Reviews

industry which, because of the fluctuations of the export market and a constantly depleted soil, was an uncertain source of wealth. The Government aids to this industry and to the turpentine and rosin industries had been reacting by causing the growth of substitutes.

The TVA, however, was one of several factors that helped industrial life in the South, and by the time that World War II called for a maximum effort from the Nation, the South was already unfolding its great resources. During the war, magnesium plants and great chemical plants were established, tung oil production was expanded, more attention was given to a broader agriculture. Transportation barriers were broken down so that the South's vast agricultural, forestal, and mineral resources could be developed and become better known to the rest of the country.

"Southern Horizons" is not a propaganda essay by any regional booster. Mr. Haynes is a Connecticut Yankee who tells the story of the resources and economic development of the South in an interesting fashion. Rich in coal, iron, minerals, forest products, and with a climate that can furnish the North with food four months ahead of its own season, the South is well on its way.—GEORGE S. BRADY.

ARTICLES OF WAR ANNOTATED. By Lee S. Tillotson. Harrisburg: Military Service Publishing Company. 386 pp. $2.50.

THIS is the fourth revised edition of a standard text on the subject. First printed in November 1942, the volume has gone through nine printings since its original publication.

The Articles of War were enacted as a part of the National Defense Act of June 4, 1920. The enacting clause provides that these Articles "shall at all times and in all places govern the armies of the United States." Military law is due process of law to those in the military service.

Colonel Tillotson, in a well-documented and conveniently arranged book of 386 pages, presents in complete annotation all the Articles of War with references, authorities, and interpretations. It should be available to all military personnel and to civilians who are mindful of the unwarranted attacks which are so frequent these days against military law and order.—JOSEPH CORNWALL.

THE RUSSIAN TOKAREV SEMIAUTOMATIC RIFLE. By George R. Gans. Privately printed by Roger Marsh, Hudson, Ohio. 6 pp. 50¢.

GEORGE GANS has produced a very useful little brochure on the Tokarev rifle. It offers full information on the principle of operation of this gas-actuated weapon, together with complete directions on field stripping. For those lucky enough to possess a specimen of this excellent arm, this manual should prove extremely useful.

Whether Gans' booklet will gain wide distribution, in view of the preëxistence of W. H. B. Smith's "Basic Manual of Military Small Arms," which embodies information closely duplicating that which Gans offers, remains to be seen. Let us hope that it does, since any new venture in the field of arms literature is, to my mind, distinctly to be encouraged. It is to be remarked, however, that in the case of this particular number of the "Weapons Series," proofreading has been a bit careless.

The technical description is clear, terse, and simple. Illustrations, done by the master hand of the author, are fully up to his usual standard, which means that they would be difficult to improve.

A single suggestion—no mention is made of the fact that the Tokarev bolt stays open when the last shot has been fired from the magazine.—CALVIN GODDARD.

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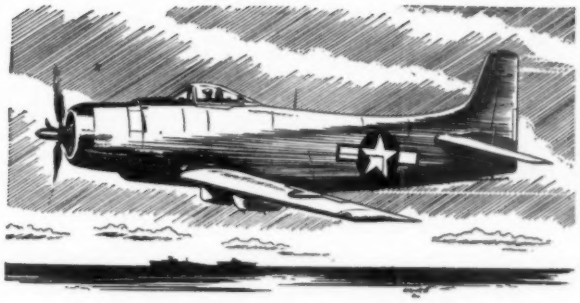

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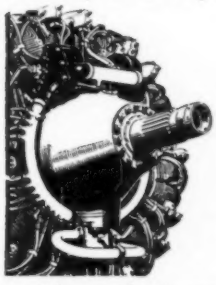

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Historical Section, Office of the Chief of Ordnance

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Book Reviews

THE ENGINEER IN SOCIETY. By John Mills. New York: D. Van Nostrand Company. 196 pp. $2.50.

THIS could have been an excellent book if the author had done with it what he and his engineers do with an ordinary engineering task; namely, revise, revamp, refine, and finally assemble the reworked and polished parts into an attractive product. There is good material in the book, based on the long and eventful career of the author, but it never got beyond the preliminary laboratory stage of preparation. To the reader it is rambling, repetitious, and tedious. There is also too much first-person narrative, which is a difficult style for the ordinary writer to do well.

It is not easy to grasp the drift and intent of the book, but if the author means to imply that the engineer and the scientist can take the lead in guiding the economics and politics of the new age, this reviewer does not agree. The very freedom of the engineer from the broad economic and political problems is what fits him to do the close inventive work. If he becomes an economist and politician he is going to unfit himself for the laboratory. The author states that the engineer and scientist can apply the objective method of science to our lives and surroundings. He forgets that human beings with free will do not react like the materials in his test tube. The reviewer recommends waiting for a second revised edition before reading this book.—GEORGE S. BRADY.

PATTON AND HIS THIRD ARMY. By Col. Brenton G. Wallace. Harrisburg: The Military Service Publishing Company. 250 pp. $3.

BY presenting a wealth of facts, many of which would not be known to other authors, in an easily read and interesting style, Colonel Wallace has prepared a book which is not too professional for the nonmilitary reader but of sufficient interest that it should be included in the library of those who are of the military profession, particularly those who served in the ETO. The account of exciting staff meetings on the eve of critical actions by the fast-moving, hard-hitting Third Army gives a background for understanding the events that thrilled the world and earned the fearful respect of the enemy.

Several times General Patton chafed under the decisions of higher authority, but at no time was there any question of his personal loyalty and obedience to Generals Eisenhower and Bradley. In his eagerness to destroy the enemy and end the war quickly, General Patton wanted to close the Falaise pocket, to storm the Siegfried Line in September, and go on to Berlin in March, but orders from his superior commanders restrained him to comply with carefully considered over-all plans.

It is quite likely that most readers will agree with the reviewer in wishing that more space had been devoted to General Patton as an individual. A man of quick but firm decisions, General Patton was hated by some as strongly as he was loved by the majority, but all were proud to have served in his Third Army.—BENJAMIN S. MESICK.

CARGO DEADWEIGHT DISTRIBUTION. By Martin Heuvelmans. New York: Cornell Maritime Press. 96 pp. $1.50.

THIS little book, written by a man who during the war was superintendent of stevedoring at the New York Port of Embarkation, has simplified the principles and procedures of cargo loading for space saving, good stability, and to meet the requirements of proper weight distribution. It is in simple language illustrated with line drawings and is intended for ships' officers and for those responsible for shipping freight overseas.—GEORGE S. BRADY.